THE FOUNDRY

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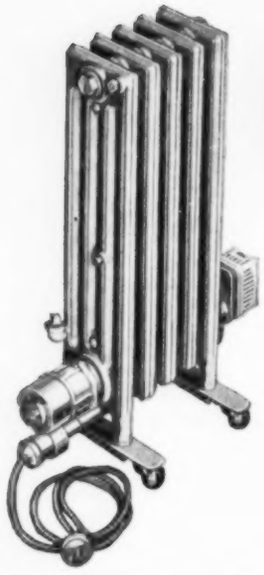


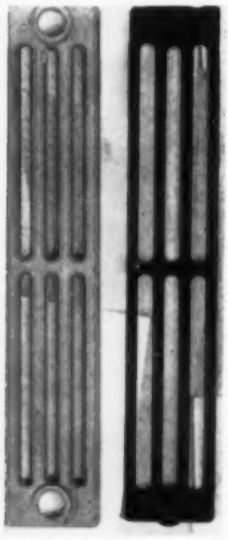
Portable Electric Steam Radiator with thermostat control and indicator light. 21 inches high. Made with "Slenderized" sections.

Good Cores

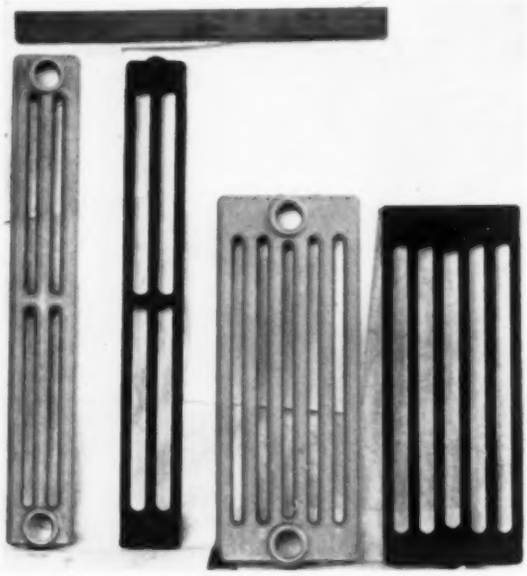
Pictures of everyday work of Zanesville, Ohio, Radiator Plant of

Burnham Boiler Corporation

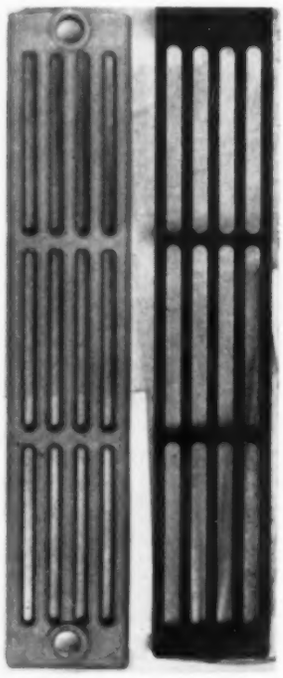
SLENDERIZED RADIATORS constitute a large percentage of the castings of this foundry. Core columns measure only ½ inch in diameter and metal walls are poured ⅛ inch in thickness. No wires nor other reinforcements of any kind are used in these cores, and breakage is almost negligible.



Burnham's have only normal foundry losses on these ⅛-inch slenderized castings.



For actual size of sections and cores, note 18″ rule in picture to left.



Linoil cores produce little gas and are extremely free-venting. This is due both to the nature of Linoil and to the small amount required to get cores of the necessary strength. Use Linoil to reduce gas blows.

A. F. A. Convention and Exhibit in Milwaukee, May 3rd

THE WERNER G.

THE FOUNDRY

For March

Events Reveal New Economic Problems

EVENTS of tremendous importance to industrial America are transpiring with such rapidity that clear insight into future business trends is difficult. Debate on proposed "reforms" in the judiciary hardly was well underway before much new legislation, including a new NRA, definitely was predicted. During the first week of March, interest centered in the Pittsburgh district where the steel industry provided most significant developments in labor relations. Almost immediately following wage increases, prices of most iron and steel products were boosted, and a further strengthening of prices on these materials probably will follow shortly.

What immediate effect will these and other developments have upon the foundry industry? While many foundries have been operating on a 40-hour week for some time, the remainder of the industry probably will move at once in that direction. Authorities seem to agree that further wage and salary increases are inevitable. As previously mentioned, prices of raw materials have risen and will go higher. Therefore, an immediate increase in the price of all classes of castings is mandatory. Estimates indicate an increase of from 10 to 15 per cent will be necessary immediately to meet only apparent production and material costs. The foundryman who fails to solve this problem of proper pricing of castings now surely is welcoming commercial disaster.

At the same time, the foundry industry as a whole should benefit from experience of previous NRA days. As we move toward more extensive governmental control, it appears that once again trade associations will be the mouthpieces of all classes of industry. As before, those industries best organized with strong trade associations will command and receive the most satisfactory treatment at Washington. It is fortunate that the three ferrous branches of the foundry industry have well organized trade associations led by officers with vision, courage and ability. The steel and malleable organizations are receiving splendid co-operation from their respective branches, and are in position to render maximum service in the future. Undoubtedly the society in the gray iron branch should prove a vital necessity to the industry in the days to come. As a matter of protection for the immediate future, that organization should have the co-operation and support of all captive and jobbing gray iron foundries in the United States. Organization efforts also should be undertaken in the nonferrous foundry field.

Should Know the Handbook

TWO years ago the American Foundrymen's association published the *Cast Metals Handbook*, following intensive work of many association committees embracing several hundred of the metallurgical and technical leaders of the foundry industry. The book represents the first authoritative treatment of the entire field of engineering properties of cast metals, and provides a marked service to designing engineers, professors in engineering schools, buyers of castings and to every foundry in the country producing quality castings.

Some consideration is being given to revision and a new edition. Remarkable progress in the improvement of castings produced by all branches of the industry necessitates continual study and work on the part of the many companies and individuals who have given willingly of their time, experience and knowledge that the industry as a whole might benefit. This work will go forward under the able direction of association officers.

Conversations here and there leave the impression that foundrymen themselves have not taken full advantage of the opportunities offered through the publication of the handbook. It is doubtful if the data presented in that publication is being used by many of those teaching design in the engineering schools. Older handbooks with physical properties at least 20 years out of date still are being quoted in the class room. Not all designing engineers are familiar with the properties available in castings today, although they may have copies of the handbook.

Responsibility for properly selling the facilities offered by the *Cast Metals Handbook* certainly rests with the individual members of the industry. Before work is well started on a new edition, some concerted effort should be made by foundrymen to encourage the adoption and use of this unbiased reference made available by the national association. It might not be a bad idea to check with customers as well as the nearest engineering college to see if the handbook is available and most of all, is being used.

Frank G. Steinebach
Editor

Fig. 1 (Above)—Molds are provided with dry sand pouring basins. Fig. 2 (Below)—Showing method of molding, coring and gating long bushings and sleeves

Foundry Specializes In

THE Frank Foundries Corp., operating a gray iron foundry in Davenport, Iowa, and another gray iron foundry across the river in Moline, Ill., has pursued a policy for many years which basically may be described as working on the long pull. The Davenport shop dating back to 1898 is devoted to the production of a miscellaneous line of general jobbing castings within a weight limitation of approximately 10 tons. The Moline foundry established in 1915, and enlarged on several occasions falls under the classification of specialty or production shop where duplicate castings of various kinds are produced in large volume and where the weights range from a few ounces to approximately 200 pounds. In this foundry also the majority of the castings are poured from special alloy iron. At present the output of both foundries of the Frank corporation is approximately 100 tons per day.

Present description is confined to some of the features in the Moline foundry where the management, over a period of years, has concentrated on the development of business among customers who require some special quality in their castings, wear resistance, heat resistance, pressure proof, or other special physical property outside the range of ordinary gray cast iron.

This feature of supplying a quality product attracts many classes of castings that other foundries consider undesirable on account of the exacting special requirements that involve an unusual amount of planning, selection and utilization of raw materials, and close su-

In Difficult Jobs

By PAT DWYER

Fig. 3 (Above)—Every man has his own favorite stance for pouring. Fig. 4 (Below)—The dry sand ring core is held temporarily in the cope by two light clamps

pervision. The organization chart through which the foundry functions is shown in Fig. 11.

Dealing with customers, particularly new customers, the company emphasizes the fact that it is not merely attempting to sell them so many tons of cast iron. It is furnishing the raw material needed in *their* product. The foundry endeavors to handle its part of the job in a manner that will permit the customer to produce a satisfactory article that in turn may be disposed of at a profit and meet the requirements of the ultimate consumer. Briefly, the practice conforms to the Rotary ideal, an ideal founded on sound business principles, and incidentally on principles that pay dividends to the practitioners.

In addition to well defined positive policies, the company also has adopted several very definite negative policies. For example, the company will not solicit business, or accept orders from a prospective customer whose credit rating is not satisfactory. It is claimed that when a customer does not or cannot pay his bills in 30 days, a foundry ceases to function as a foundry and must function as a bank. The customer is notified that the foundry does not want to enter the banking business. Furthermore if the customer cannot pay the account in 30 days the foundry has no setup which will permit a continuation of making the castings.

No orders for castings are accepted unless the account shows a definite profit. As a general rule the company does not solicit or accept business solely on a price basis. Where a shopping

Fig. 5 (Above)—Through a well equipped laboratory, close control is exercised over both raw materials and finished product. Fig. 6 (Below)—Joints on half sleeve cores are ground to a true surface

customer is more interested in price than in quality, or where the mature judgment of the company executives indicates that their plant, methods and facilities are not in a position to be of service in supplying a better product, the company is not interested in any inquiries. Selling effort is confined to customers whose business will be of mutual benefit.

All raw material is purchased to close specification and inspected before acceptance. This eliminates one of the many variables which confront any manufacturer in his attempt to turn out a perfect product. Special and routine testing of raw material and product are conducted in a well appointed laboratory, part of which is shown in Fig. 5. Carbon determinations are made according to standard practice in approximately 8 minutes in a small electric furnace where a stream of oxygen is passed through the sample in a tube at a temperature of 2300 degrees Fahr. The oxygen combines with the carbon as CO_2 and then passes through a container filled with a soda asbestos compound. The container is weighed before and after the operation. Increase in weight represents carbon dioxide which when multiplied by 27.27 and divided by the weight of the sample represents the percentage of total carbon in the iron. In this particular instance a table of values posted near the apparatus eliminates the necessity for multiplication and division.

Sand from various sections of the foundry is tested on apparatus made by the H. W. Dietert Co., Detroit. In this manner close control is maintained over the permeability, green and dry strength and moisture content.

Close Tolerance Is Maintained

A typical instance of the close tolerance demanded on the castings and the effect of the sand in maintaining accuracy is illustrated in a clutch plate casting. Inspection of several castings showed a slight recession from a true straight line across the cope face. By a process of elimination, diagnosis of this defect indicated that the sand on the cope face was too *tight* with the result that a sufficient amount of air was held in compression long enough to form a slight depression on the cope face of the casting. On ordinary castings the slight inaccuracy would not be noticed. In this instance where the machine finish was confined to a single grinding operation, the castings were rejected. Substitution of a coarser, more permeable grade of sand in the cope solved the problem.

Meticulous care observed in every detail to insure accuracy is typified in the method employed in making test bars for checking transverse and tensile strength. The bars, circular in cross section conform to standard A. S. T. M. specifications 1.20-inch diameter and 21 inches in length broken for transverse test on supports 18 inches apart. Foundrymen generally are familiar with a potential hazard to accuracy when these bars are molded and cast vertically, in a one-part flask or molded and cast horizontally in a two-part flask. In the first instance, on account of the static pressure, the bar may be larger in diameter at the bottom than at the top. In the second instance a slight ridge or fin along the parting line introduces a variable factor.

Both of these factors have been removed in the method employed in the Frank foundry. Two solid patterns are mounted in a follow board and the drag of a two part flask is rammed in the usual manner and (*Please turn to page* 89)

Fig. 7—Alloy castings are subjected to various types of heat treatment

A.F.A. Serves Foundry Industry In Variety of Ways

By DAN M. AVEY

Secretary-Treasurer, American Foundrymen's Association, Chicago

This discussion was presented at the recent joint foundry practice meeting held in Birmingham

A TOUGH old foundryman, some 20 years ago, looked up from his grimy pile of blue prints, wiped away the sweat of honest mental labor and observed a young engineer, fresh from knowledge halls and starry eyed with eagerness.

"What do you want, son?" he said.

"Well, sir, I'd like a job," the eager one said, "I'm a graduate from the state college."

Restraining a perfectly natural impulse to say, "take mine," the foundryman inquired, "What made you want a foundry job?"

"I've watched foundrymen work for a long time," he said, "and it always looked to me like you didn't have to *know* much to be a foundryman."

Naturally, this is fiction. A foundryman has to know a lot to handle his job. And no college graduate ever confessed that *he* didn't know much particularly if he was a product of our engineering schools.

Is business rebuilding as it comes out of the depression? Is the foundry business getting set to tackle its problems, and what are they?

Nationally industry faces a shortage of men, with the spectre of unemployment still stalking the land. All industry has the further twin problems of production and exchange—not distribution. The man who invented this word distribution must have had a license from the Amalgamated Red's propaganda office. We don't distribute goods—yet we exchange what we make for the products of others labors. Col. Chevalier of McGraw-Hill says if we eradicate this *distribute* thought we've gone far in solving all your public problems.

Next is a balanced budget, no less important to the small manufacturer than to the national government. And an unbalanced budget—take in $1 and spend $2—is just as fatal to either a business or a government. Just quicker in the former case.

These problems are all foundry problems. They concern the owner, his superintendents, foremen, metallurgists and all down the line to the laborer that wrestles scrap.

Is business rebuilding as it comes out of the depression? Is the foundry business?

What about plant and machinery? What of manpower?

The foundry industry is made up of thousands of plants. Some are departments of other types of manufacture. The jobbing foundry has the worst end of the stick.

It is recognized that 3 good years must provide the means to meet declining business and loss in 5 that are bad. The foundry, whether captive or jobbing, must garner enough to carry over. Most certainly the shop that sells castings *must* have profits.

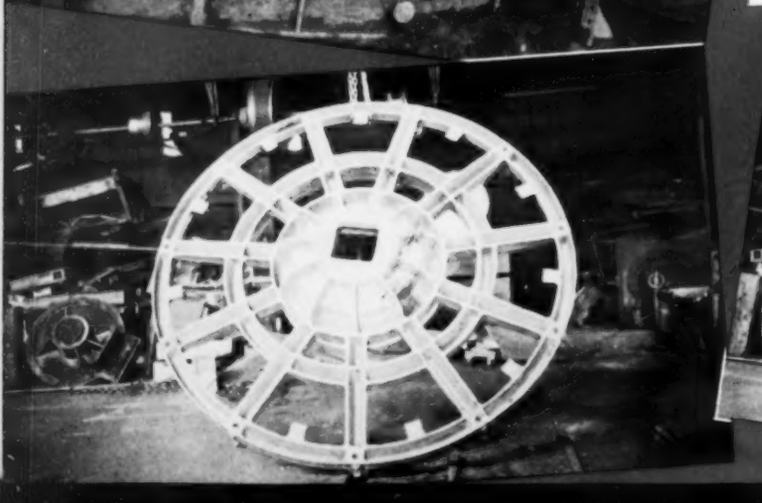
Consider the matter of proper equipment to replace that which is junk and to buy newer types that make for economy in use. Replacing obsolete machinery is a prime necessity in good times.

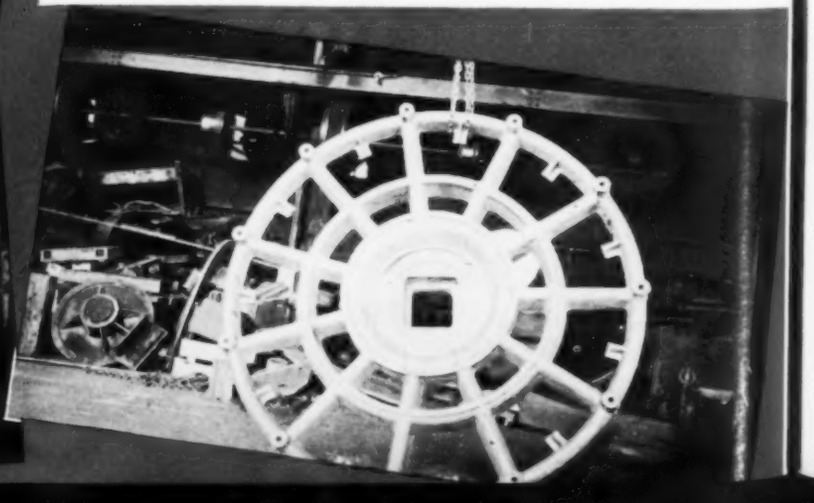
The administration apparently does not view this problem with much concern. On a purely nonpolitical basis, nothing of greater damage to jobbing foundries could have been concocted than the excess reserves tax. It compels by taxation a policy that piddles away earnings in dividends and penalizes saving for investment in plant replacement. But what can we do about that? Not much, although apparently a few in Congress feel that some exception should be made to set aside and credit money actually expended on machinery and plant purchases.

Representations were made to Washington to show that the foundry industry is ill equipped. It is much worse off than in 1914 and would be crippled in event of war demand. This fact was directed to the attention of some lawmakers with the suggestion that this condition existing in all heavy industry—vital in event of unexpected war requirement, should warrant the remission of tax upon enough reserve funds to provide machinery purchases. The further thought that RFC look with favor on loans to foundries—favoring such types of manufacture over the concoction of cosmetics or the weaving of silk hose—and with the same intent of bolstering, preferentially, the probably primary and secondary war service requirements, met with no encouragement.

But why worry about what we can't control? Let's do a bit of concentrated worrying on the things we can fix—perhaps.

Timidity, born of panic, still governs in pricing castings. With higher prices all about, with shortage of men, increasing costs and enough hand writing on the wall to give old Nebuchanezzar indigestion, if grass didn't, some foundries still (*Please turn to page* 92)





Bed Used for Many Castings

By JOHN D. BABBITT

METHOD of molding the casting shown in the accompanying illustrations at the foundry of the Willsea Works, Rochester, N. Y., recently, presents many interesting features. A rush order for 100 of these castings was received for a plate glass polishing unit. Only one pattern was available and it was believed that two or three castings per week represented the limit of output. However, by adopting the method shown in the accompanying illustrations the order was completed at the rate of 9 per week. Three drags, two circular and one square, were utilized. No copes were needed as the mold was made almost entirely in dry sand cores. The cores were held down by flat plates clamped to the upper flanges of the drags.

Three cast iron ring plates of rather heavy section were cast, faced on one side and a recess turned to fit the core print on the center of the pattern. A bar across the center of the ring plate was drilled in the center for a spindle. A sweep mounted on this spindle made the first, or permanent bed and afterward was

Above—Mold in different stages of construction. Center—Cover core and finished mold. Bottom—Front and back of casting

used for checking this bed each time it was used.

The ring plate was leveled on the floor and the drag placed in position after which a permanent bed was formed of a strong dry sand facing, containing about twice the usual amount of pitch and gravel. The three beds served to complete the entire order. The bed was trimmed on the edge to suit the contour of the pattern. A wall of about 6 inches of green sand was rammed on the outside edge of the pattern. This was the only green sand used in making the mold.

In starting each job the molder cleaned up the permanent bed, trimmed away all the crumbled sand and checked the accuracy of the bed with the spindle and sweep. The pattern then was placed on the bed, green sand was tucked under the edge, rammed up to the top of the pattern where a parting was made. The pattern then was removed. The large center bottom core then was placed in the recess provided in the base ring for that purpose as shown in Fig. 1. The remaining cores which formed the drag part of the mold then were placed in their proper position on the permanent bed. These cores and all the others required for the mold were so nicely made that one was reminded of the Biblical narrative covering the building of Solomon's Temple. It was built of stones made ready at the quarries so that there was no sound of hammer nor axe, nor any tool of iron heard in all the building or its surroundings.

Fig. 2 shows the mold with most of the drag cores in place and with the large hub covering core in the center. The other side of this core is shown in Fig. 4. Several cover cores for the ribs are shown on the edge of the flask in Fig. 2. The mold with nearly all cover cores in position is shown in Fig. 3. With all the cores in position a bed of sand was placed on top of the cores and a covering plate was rubbed down to a bearing and then clamped to the flange of the flask. On the square drag shown in Fig. 5, individual plates were adjusted over the corners. A weight was placed over the center.

Fig. 5 also shows one of the molds ready for the metal, with the exception of the weight over the center. A long runner basin conducted the metal to a central sprue which passed through the central cover core Fig. 4 and part way through the lower center core in the drag. In this lower core the sprue was connected with six radially disposed horizontal gates, three of which may be noted in Fig. 1. The casting was 8 feet in diameter, wall thickness ⅝-inch excepting around the center where it was 1 to 1¼-inches. Average weight of the castings were 2200 pounds and pouring time 50 seconds. The entire order of 100 was completed without the loss of a single casting. A full measure of credit is due the patternmakers, coremakers, molders, helpers and foremen, also the man at the spout who provided *hot ones* as required.

In Africa They Have a Name for It

By JAMES FARRON

PERHAPS it merely was a coincidence—queer things happen in the foundry—but George knows what he knows and he is not telling every person. Certainly it was extraordinary. Even after the lapse of 30 years and a varied foundry experience, I am not prepared to say positively that there is no such thing as a hoodoo. Maybe not and then again may be—Well, here, read for yourself and draw your own conclusions.

After a long sea voyage I was glad to feel the solid earth once more under my feet when I landed in Cape Town, South Africa, early one October morning in the year 1900. My ultimate destination was Johannesburg, 1500 miles in the interior, but I had plenty of opportunity to admire beautiful Cape Town before I could proceed to Johannesburg several months later.

All the seaport towns were crowded with refugees. The Boer war had everything tied in a hard knot. I was too young for military service and had no choice but to sit still and wait.

The warring factions still were active and furnished many thrills during our 5-day journey to the greatest mining town in the world, a city whose very foundations rest on the great gold reef. Here I was apprenticed in a foundry and remained 6 years.

The small brass foundry was operated by a hard working gentleman from Alabama, whose duties were to get out the orders. The duties of his partner were to bring in the orders. The general run of work included bronze bearings, gears, pipes, and various other castings which come into use in the maintenance of a gold mine.

As second apprentice my duties were to help the melter, a Matabele Kaffir, black as ebony, but who could speak English very well. In a few weeks I learned sufficient of his dialect to converse with him in his own tongue. On rare occasions he became excited and used no other, and that brings us down to the hoodoo.

This particular pattern—an S-shaped, 2000-pound pipe—came in one day to be cast in phosphor bronze. George did not look with favor on this job, and was not backward in branding it a hoodoo from the time the pattern came into the shop until the casting was completed. Whether by native instinct or whether things just came about, never will be known—but George was right.

The mold was made from a skeleton pattern, the bottom half bedded in the floor. The core also was made from skeleton core boxes. The whole procedure was extremely interesting and instructive to a novice.

Attending four pit furnaces (*Please turn to page* 86)

Cast Camshafts and Crankshafts Possess Many Advantages

By FRED J. WALLS
International Nickel Co., New York

This is the first of a series of two articles abstracted from a paper presented by the author at the Feb. 9, 1937 meeting of the New England section of the Society of Automotive Engineers. The second article will appear in a forthcoming issue.

OUR old conception of cast iron as being an unreliable, weak, brittle metal has been changed by the coordinate efforts of engineers, metallurgists, and founders. We now have a versatile material possessing virtues in designs where dependability and durability are primary requisites.

The crankshaft which converts the reciprocal motion from the power producing factors of an internal combustion engine into rotary action, and the camshaft which controls these factors must be reliable and economical to an extent equal to the wrought materials which they have replaced, if they are to be adopted in modern production.

Large Quantities Now in Use

It is evident from the quantity now in use and the present daily consumption that both of these important parts made from cast material are performing satisfactorily.

It would require a lengthy volume if one were to cover in detail the development of cast cams and cast cranks, but any statement should not be acceptable unless it pays tribute to those foundrymen, metallurgists and engineers whose foresight, courage, and continued experimentation have made the present volume production a pleasant reality. The Campbell, Wyant & Cannon Foundry Co., the Caterpillar Tractor Co., the Ford Motor Co., and many others justly deserve words of praise for their contributions in elevating cast ferrous materials to the status which they now enjoy.

The natural question which production engineers ask is, "What are the factors that justify the substitution of cast materials for forged materials in camshafts and crankshafts?" These factors may be classified under the following general headings: Economy, engineering design, and material characteristics.

Changes Are Made Readily

From the standpoint of economy the initial outlay is considerably reduced in the casting process as compared to the forging process. Pattern costs, as a rule, will be several times less than the cost of a die, and in the cost of new designs where changes are sometimes found necessary, pattern changes are readily made while changes in dies are usually difficult, if not impossible to make.

Expensive forging equipment and heat treating furnaces are not needed for cast materials. Reduction in machining costs made possible by the use of cast materials has been described in the literature quite exten-

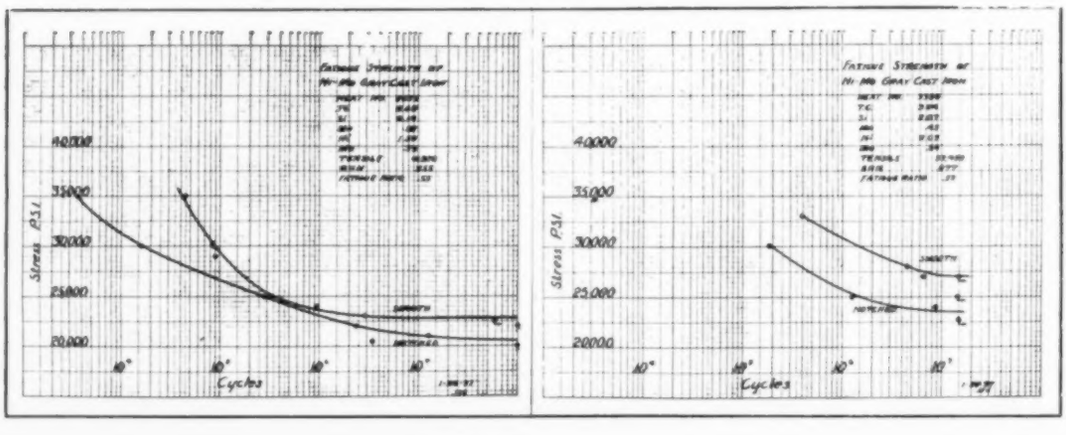


Fig. 1 — Endurance limit of a nickel-molybdenum gray iron made in the crucible. Fig. 2 — Fatigue test results and composition of another alloy iron

ively and need not be touched upon in this discussion.

From the standpoint of engineering design it may be said that the engineer has been presented with possibilities which he has often dreamed of, but which could not be carried out in forging designs. By the casting process it is possible for him to locate his counter weights and control gravity centers at those points where his mathematical calculations show they should be placed.

Crank pins, bearings, and checks may be cored out, thus eliminating a great deal of unnecessary weight, which is often expensive to remove from a forging. By proper design this elimination of weight often times increases the engine output by the reduction of physical forces.

The improvements in characteristics of cast materials through the use of alloys, metallurgical control of melting operations, improved molding conditions, and technical control in the foundry have taken the guess work out of the casting process and made the uniformity of production more certain and dependable.

Better knowledge of the physical properties of this improved material is probably the most important factor pertaining to the substitution of cast materials for forgings. This has been brought about through organized research and unlimited practical tests.

Outlines List of Qualities

The physical properties which are so essential in cast cams and cast cranks may be summed up as follows: Rigidity, wear resistance, torsional strength, fatigue strength, and damping capacity. I wish to touch briefly on a few of these properties which are being quite thoroughly explored at the present time.

It is evident, if one reviews the literature, that the fatigue properties of high strength cast irons have not been explored sufficiently to set up, as an engineering standard, an endurance limit having a definite ratio with respect to tensile strength. This factor has been established tentatively by various investigators as ranging from 40 to 50 per cent of the tensile. However, recent investigations seem to indicate that the endurance limit of the 50 and 60 thousand pounds per square inch class irons can be assumed to be 50 per cent of the ultimate tensile strength. There are further indications

Table I

Crankshaft Iron Properties

Type	Ni-Mo	Ni-Mo
Heat No.	3386	3387
Furnace	Cupola	Cupola
Total carbon	3.04	3.06
Silicon	2.07	2.17
Manganese	0.45	0.62
Nickel	2.03	1.70
Molybdenum	0.34	0.62
Brinell hardness number	277	241
Tensile, pounds per square inch	52,450	52,900
Modulus, pounds per square inch	18.27×10^6	18.45×10^6
Fatigue limits		
Smooth, pounds per square inch	27,000	27,500*
Notched, pounds per square inch	23,500	25,500*
Fatigue ratios		
Smooth	0.515	0.52
Notched	0.45	0.49
Transverse strength (pounds)	5905	6205
Transverse deflection (inches)	0.157	0.212

*Approximately.

that the structure and chemical composition have an important bearing on the endurance limit. Fig. 1 shows results obtained on a nickel-molybdenum gray iron made in a crucible.

If it is true that the endurance limit varies linearly with the tensile strength, then we may conclude that an iron having a tensile strength of 50,000 pounds per square inch has an endurance limit of about 50 per cent, or 25,000 pounds per square inch. Therefore, an iron having a tensile strength in the neighborhood of 70,000 pounds per square inch would have an endurance limit of approximately 35,000 pounds per square inch.

Cast Iron Sensitive To Notch Test

The sensitivity to notch effect on cast iron has been reported to show a reduction in the endurance limit of from 5 to 25 per cent, depending somewhat on the shape of the notch. Two notch fatigue tests using a square notch, as I will later outline, show a reduction in the endurance limit of approximately 10 per cent, which is considerably lower than that exhibited by steel.

It is this low sensitivity to notch effect that places cast iron in a position to compete with a material whose higher initial strength and endurance limit, in a smooth specimen, is reduced to the same level, or even lower

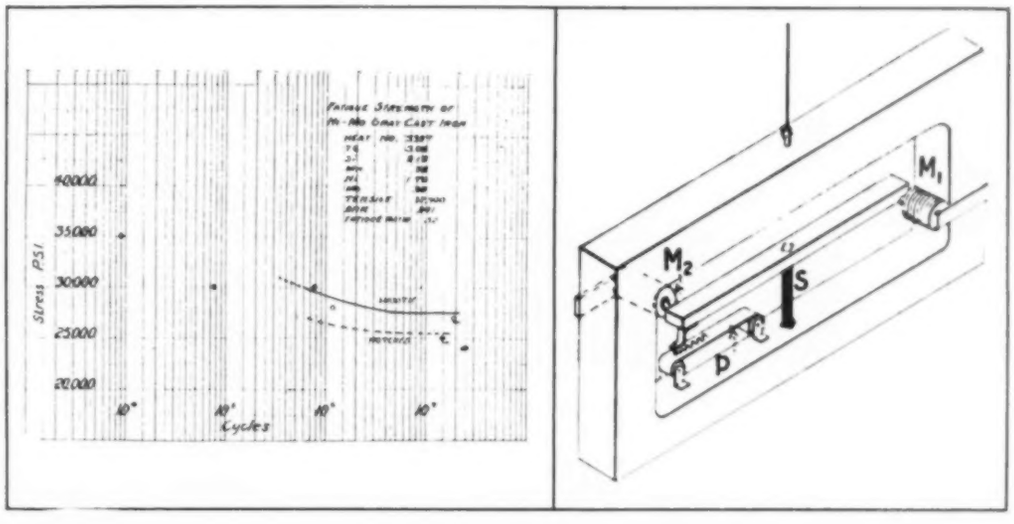


Fig. 3 — Composition and fatigue data on a nickel-molybdenum cast iron. Fig. 4—A device for determining the damping capacity

when square corners, notches, grooves and stress concentrating centers such as oil holes are introduced in the casting.

Fatigue tests on two different nickel molybdenum gray irons made in the cupola are shown in Figs. 2 and 3 with the composition and other physical properties of these irons. The tests on heat No 3387 are now in progress, so the curves cannot be drawn definitely. However, we do know that the endurance limit of the smooth bar is approximately 27,500 pounds per square inch and the limit of the square notched bar is at least 25,000 pounds per square inch as shown in Table I. The gray iron test specimens were cut from arbitration bars in a section half-way between the center and the edge, and are a modified Moore type having over all a length of 3 7/16 inch, a maximum diameter of 0.480 inch at the shoulders and a reduced section of 0.300 inch diameter.

Notch Projected on Microscope

The test section is cut to a radius of 3 53/64 inch. The notched specimens have a square notch which has a width of 3/16 inch and a reduced section of 0.300 inch (maximum section is 0.480 inch). The squareness of each notch is observed on the microscope by projecting its shadow on the ground glass before testing. The tests were conducted in R. R. Moore rotating beam machines revolving at 1750 and 3500 revolutions per minute. Graphic presentation of results of these tests is shown in Figs. 2 and 3.

Damping capacity is defined as the amount of work dissipated into heat by a unit volume of the material during a completely reversed cycle of unit stress. It is the energy lost in the conversion of potential into kinetic energy and measured in inch pounds per cubic inch per cycle. The *specific* (*Please turn to page* 83)

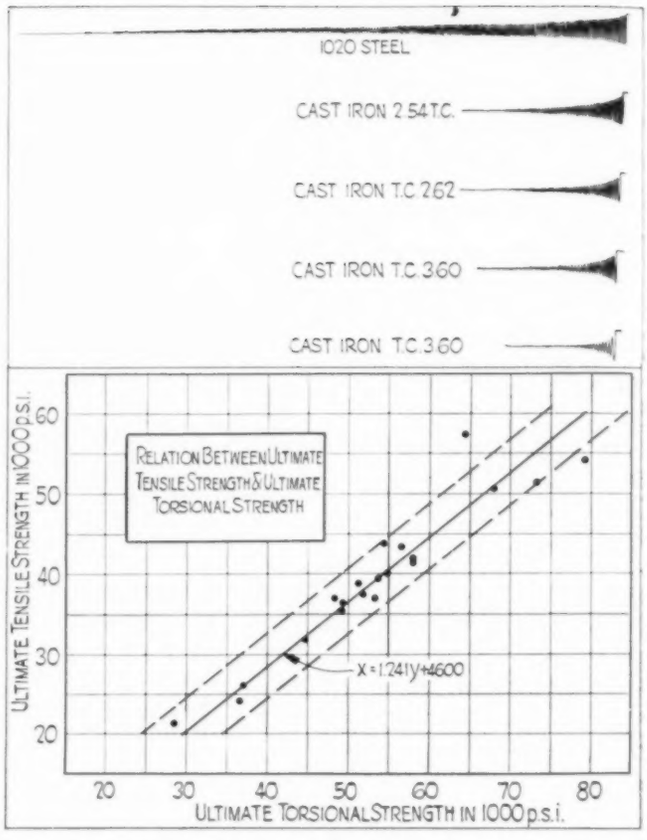


Fig. 5—Vibration damping curves of steel and cast irons. Fig. 6—Torsional properties

TABLE II

Chemical Analyses and Physical Properties of Test Specimens

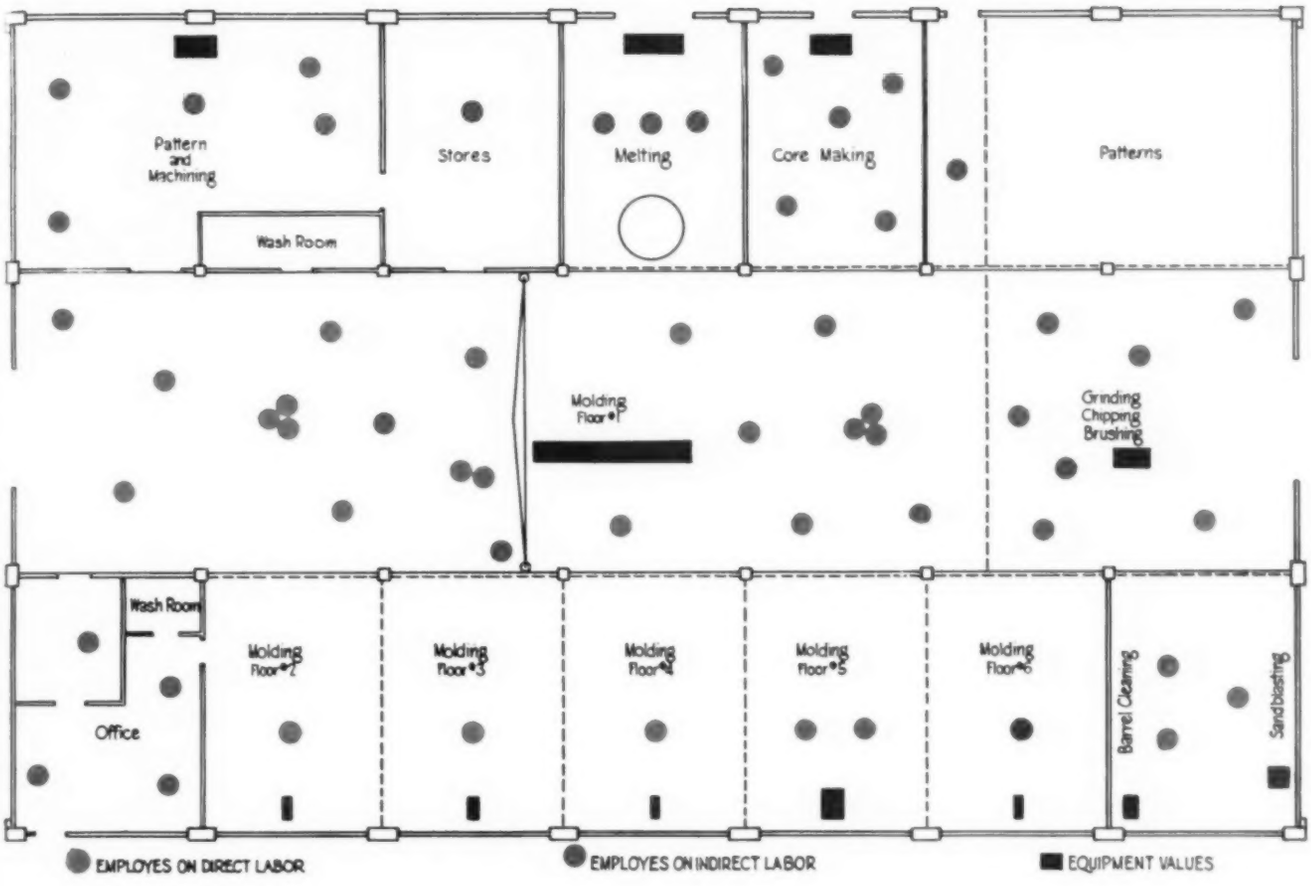
CHEMICAL ANALYSIS

Heat No.	T. C.	Si	Ni	Cr	Mn	Other
9907	3.32	1.54	1.06	....	*0.6	....
9908	3.19	1.43	2.04	....	*0.6	....
8550	2.93	1.36	4.81	....	*0.6	....
8568	3.22	1.72	1.20	0.51	*0.6	....
9910	3.24	1.41	1.30	0.21	0.43	....
3342	3.20	1.20	1.50	....	*0.6	0.42 Mo
3372	2.76	2.07	1.57	....	0.75	0.69 Mo
8613	2.39	1.77	1.80	....	*0.7	0.72 Mo
8606	2.56	1.37	1.97	....	0.72	0.72 Mo

*Approximately.

PHYSICAL PROPERTIES

Heat No.	Arbitration Bar Transverse Test 12-Inch Span Stress in Lbs.	Arbitration Bar Transverse Test 12-Inch Span Deflection in Inches	Arb. Bar BHN	Ultimate Tensile Strength in PSI	Torsion Tests: Prop. Limit in PSI	Torsion Tests: Yield Stress in PSI	Torsion Tests: Ultimate Strength PSI	Shearing Modulus of Elasticity PSI x 10^{-6}	Permanent Angle of Twist Degrees Per In.	Ratio of Tortional Proportional Limit to Ultimate Strength
9907	4525	0.17	212	38,600	16,980	36,580	50,250 52,300	5.40	3.82 4.20	0.338
9908	3700	0.13	212	39,280	18,200	33,380	54,450 53,000	5.50	3.68 0.70	0.334
8550	3515	0.11	331	41,400	20,000	37,000	57,900 58,000	5.33	2.51 2.20	0.346
8568	4720	0.15	248	40,000	17,600 13,950	34,700 34,350	54,200 54,600 55,300	5.15 5.825	5.36 2.68 2.80	0.324 0.255
9910	4540	0.16	212	36,860	20,600	31,290	49,500 47,000	5,138	3.83 2.10	0.416
3342	5500	0.19	241	43,420	19,400	37,000	58,800 54,200	6.215	1.92 2.10	0.330
3372	6090	0.18	255	54,100	15,780 16,980	40,000 44,000	74,000 84,500	7.16 7.00	5.61 4.60	0.213 0.201
8613	5210	0.12	293	50,500	47,900 47,400	63,500 72,000	63,500 72,000	8.84 8.13	1.92 2.05	0.754 0.659
8606	5380	0.15	293	51,390	33,980 40,100	62,700 64,800	75,700 70,600	7.56 7.11	1.15 1.15	0.449 0.568



Common Sense Cost Estimating

By ALBERT E. GROVER
Cost Consultant

ESTABLISHMENT of a dependable basis for calculating costs of individual jobs in a foundry requires the application of considerable common business sense. The author presents a method of establishing normal operations especially suited to the needs of jobbing foundries.

The first consideration of the foundry executive is how to conduct his business so that he may get a satisfactory return on his investment in land, buildings, equipment, inventory and accounts receivable. This in the face of the keenest and too often ignorant competition.

Foundrymen generally base their estimating data on normal operations, either by:

A. Averaging actual operation costs over past years.
B. Using tonnage shipped in periods of estimated normal operation.
C. Using an arbitrary per cent of tonnage shipped in best six months in last 10 years.
D. Consideration of the physical capacity of the foundry to convert metals into shapes suitable for the customers use.

Averaging actual operation costs over past years is an unsound basis, because the average is very likely to be different from actual conditions today.

Using tonnage shipped in periods of estimated normal operation does not take into account the constant changes in types of castings from year to year. For instance 1926 might be considered a normal year and the production have been 50 pounds per molder day. Whereas the foundry might now either by increased efficiency of its men or by having a different type of casting in the sand, produce 700 pounds per molder day. Neither does this basis take into account the variations in weight produced by different molders in the same day or by the same molder on different days.

Using an arbitrary per cent of tonnage produced in best six months in last 10 years lends itself to the same irregularities in production per molder day, as the use of estimated normal operation.

Consideration of the physical capacity of the foundry to convert metals into shapes suitable for the customers use, eliminates these inaccuracies and irregularities of job costs caused by changed operating con-

ditions as well as changes made in the product.

The following represents a simple and yet effective way to establish normal operation for a small jobbing gray iron foundry. The same procedure can be used in larger foundries because the casting problems of the large foundry, serving the same kind of customers, is the same as the small foundry.

Floor Area Serves as Basis

The building is first laid out into departments representing the nature of work in each, as indicated in Fig. 1. The floor area is determined for each department, and subdivision. This area serves as a basis for departmentalizing:—

- Depreciation on Buildings
- Taxes on Buildings
- Insurance on Buildings
- Interest on Investment in Buildings
- Repairs on Buildings
- Heating Cost
- Lighting Cost
- Building Maintenance (Janitor, Watchman, Supplies, etc.)

Each department and subdivision is then "manned," assigning to each a sufficient number of employes to utilize the area and equipment to capacity for the regular established working hours in the day. Blue disks on the chart represent employes on direct labor and red disks represent indirect labor employes.

The utility value of equipment in each department and subdivision is determined and used as a basis for allocating:—

- Depreciation on Equipment
- Taxes on Equipment
- Insurance on Equipment
- Interest on Investment in Equipment

The black rectangular spots on the chart represent these equipment value-ratios between departments and subdivisions indicated by the size of the spots.

Having established the capacity to produce on a sensible basis for costing individual jobs, estimates for pricing jobs reflect today's operating conditions thereby enabling the foundryman to meet competition intelligently.

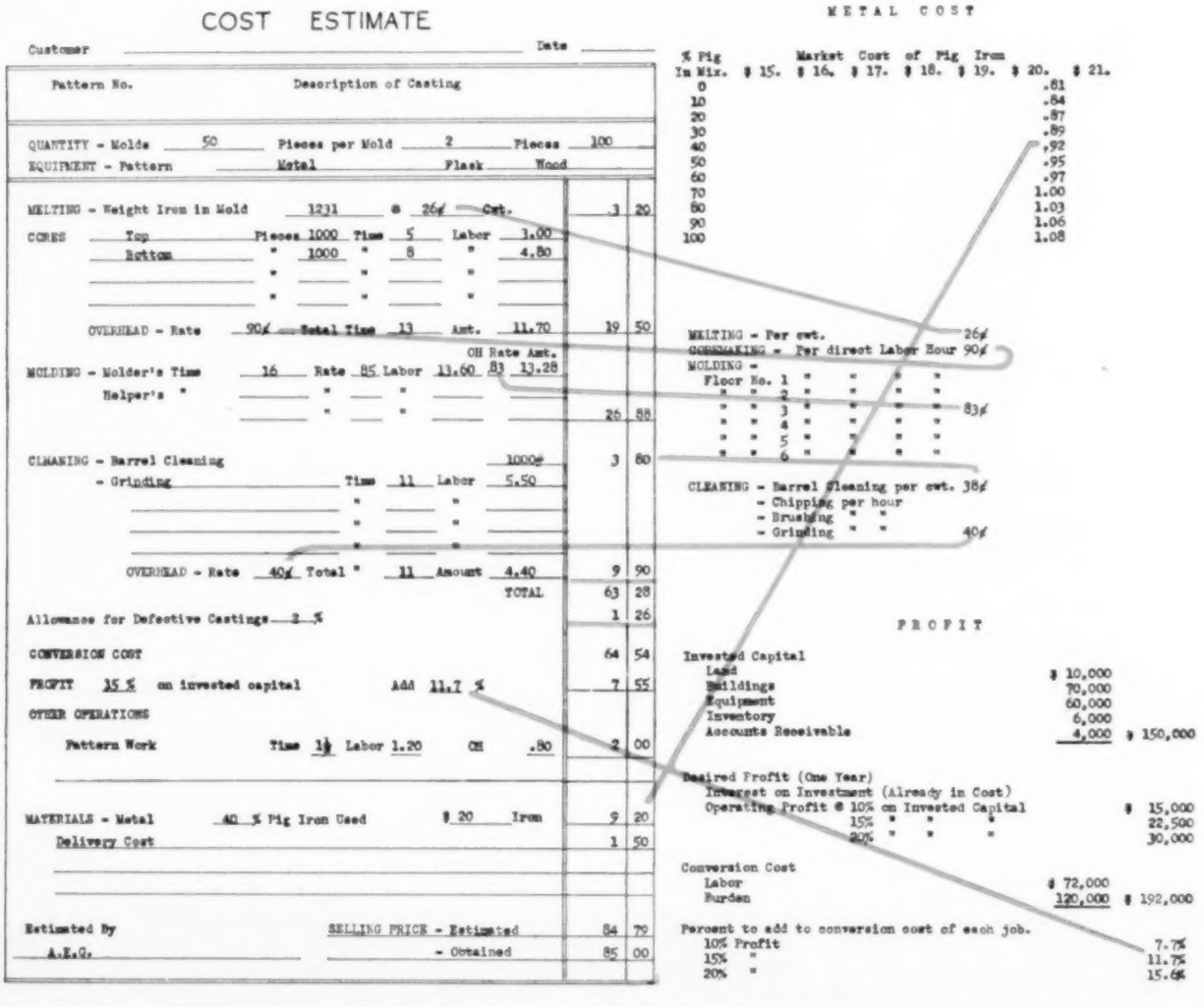
Forms Are Made Up Readily

Operation cost sheets are prepared for each department and subdivision of a department, by determining a fair normal, annual charge for each cost element in agreement with the area, equipment values and employes shown on the layout chart. Table I shows the form used. The same form is used for the other molding subdivisions. Forms for other departments differ slightly to accommodate variances in distribution bases, etc.

Estimating procedure on a time basis as indicated in Fig. 2 is as follows:

1—Indicate customer name, date, pattern number,

Fig. 2—Estimating procedure on a time basis


COST ESTIMATE
Customer
Date
Pattern No.
Description of Casting
QUANTITY - Molds 50 Pieces per Mold 2 Pieces 100
EQUIPMENT - Pattern Metal Flask Wood
MELTING - Weight Iron in Mold 1231 @ 26¢ Cwt. 3 20
CORES Top Pieces 1000 Time 5 Labor 1.00
Bottom " 1000 " 8 " 4.80
OVERHEAD - Rate 90¢ Total Time 13 Amt. 11.70 19 50
MOLDING - Molder's Time 16 Rate 85 Labor 13.60 OH Rate Amt. 83 13.28
Helper's "
26 88
CLEANING - Barrel Cleaning 1000# 3 80
- Grinding Time 11 Labor 5.50
OVERHEAD - Rate 40¢ Total " 11 Amount 4.40 9 90
TOTAL 63 28
Allowance for Defective Castings 2 % 1 26
CONVERSION COST 64 54
PROFIT 15 % on invested capital Add 11.7 % 7 55
OTHER OPERATIONS
Pattern Work Time 1½ Labor 1.20 OH .80 2 00
MATERIALS - Metal 40 % Pig Iron Used $ 20 Iron 9 20
Delivery Cost 1 50
Estimated By
A.E.G.
SELLING PRICE - Estimated 84 79
- Obtained 85 00
METAL COST
% Pig In Mix. $ 15. $ 16. $ 17. $ 18. $ 19. $ 20. $ 21.
Market Cost of Pig Iron
0 .81
10 .84
20 .87
30 .89
40 .92
50 .95
60 .97
70 1.00
80 1.03
90 1.06
100 1.08
MELTING - Per cwt. 26¢
COREMAKING - Per direct Labor Hour 90¢
MOLDING -
Floor No. 1 " " " "
" " 2 " " " "
" " 3 " " " " 83¢
" " 4 " " " "
" " 5 " " " "
" " 6 " " " "
CLEANING - Barrel Cleaning per cwt. 36¢
- Chipping per hour
- Brushing " "
- Grinding " " 40¢
PROFIT
Invested Capital
Land $ 10,000
Buildings 70,000
Equipment 60,000
Inventory 6,000
Accounts Receivable 4,000 $ 150,000
Desired Profit (One Year)
Interest on Investment (Already in Cost)
Operating Profit @ 10% on Invested Capital $ 15,000
15% " " " 22,500
20% " " " 30,000
Conversion Cost
Labor $ 72,000
Burden 120,000 $ 192,000
Percent to add to conversion cost of each job.
10% Profit 7.7%
15% " 11.7%
20% " 15.6%

description of casting, number of molds, pieces per mold, number of castings, description of pattern and flask equipment at top of estimate sheet.

2—Estimate:

A.—Weight of iron in mold.

B.—Time to make necessary cores for job.

C.—Molders and helpers time for job.

D.—Cleaning (except barrel) time for job.

E.—Per cent to allow for defective castings.

F.—Time to be required for extra operations such as pattern work, machining, etc.

G.—Per cent of profit on invested capital.

H.—Per cent of pig to be used in melt and price of pig.

J.—Delivery cost (if any).

Make Up the Estimates

These estimates may be determined either from records of costs of the same or similar patterns previously produced, or by employes qualified by actual foundry experience, designated for the job.

3—Calculate:

A.—Melting cost at cost per cwt. determined by dividing normal weight of iron melted by normal cost of melting department.

B.—Core labor cost at current wage rate of workman qualified to make this particular kind of core. If the work is to be done on a piece-work basis, multiply the number of cores to be made by piece rate. Where there is more than one core required, calculate each one separately.

C.—Core burden at normal hourly rate.

D.—Molding labor and burden in same manner as coremaking.

E.—Barrel cleaning at cost per cwt. determined by dividing normal weight so cleaned by normal cost of operating tumbling barrels.

F.—Grinding, chipping and brushing labor and burden in same manner as coremaking.

G.—Allowance for defective castings at percentage (already set) of total cost of melting, coremaking, molding and cleaning.

H.—Profit at a predetermined percentage on conversion cost that will (if made a part of the selling price) return the desired profit on invested capital.

J.—Patternwork, machining, etc. in same manner as coremaking.

K.—Metal at cost per cwt. of good castings as indicated by tables prepared to show cost per cwt.

Table I

Operation Cost Sheet

Molding Floor No. 3

	Capacity				
		90%	80%	70%	60%
Area	468 ft.	468 ft.	468 ft.	468 ft.	468 ft.
Equipment value	$600	$600	$600	$600	$600
Operator—Hours	2400	2160	1920	1680	1440
Burden					
Depreciation					
Taxes					
Insurance					
Interest on Investment					
Repairs—Buildings					
—Equipment					
—Patterns					
Electricity—Light	In actual practice, costs are extended against each of these accounts to give the totals shown below.				
—Power					
Heating					
Supplies—Fuel					
—General					
Metal Analysis					
Employe Insurance					
Indirect Labor					
Supervision					
Share of Office Salaries					
Stores Exp.—Patterns					
—General					
Total	$1900	$1800	$1700	$1600	$1500
Cost per Hour	79.2c	83.3c	88.7c	95.3c	$1.04

of good castings at different percentages of pig iron to total iron melted and at various prices of pig iron.

Estimating procedure on a tonnage basis follows:

1—Indicate customers name, date, pattern number, description and such other (*Please turn to page* 80)

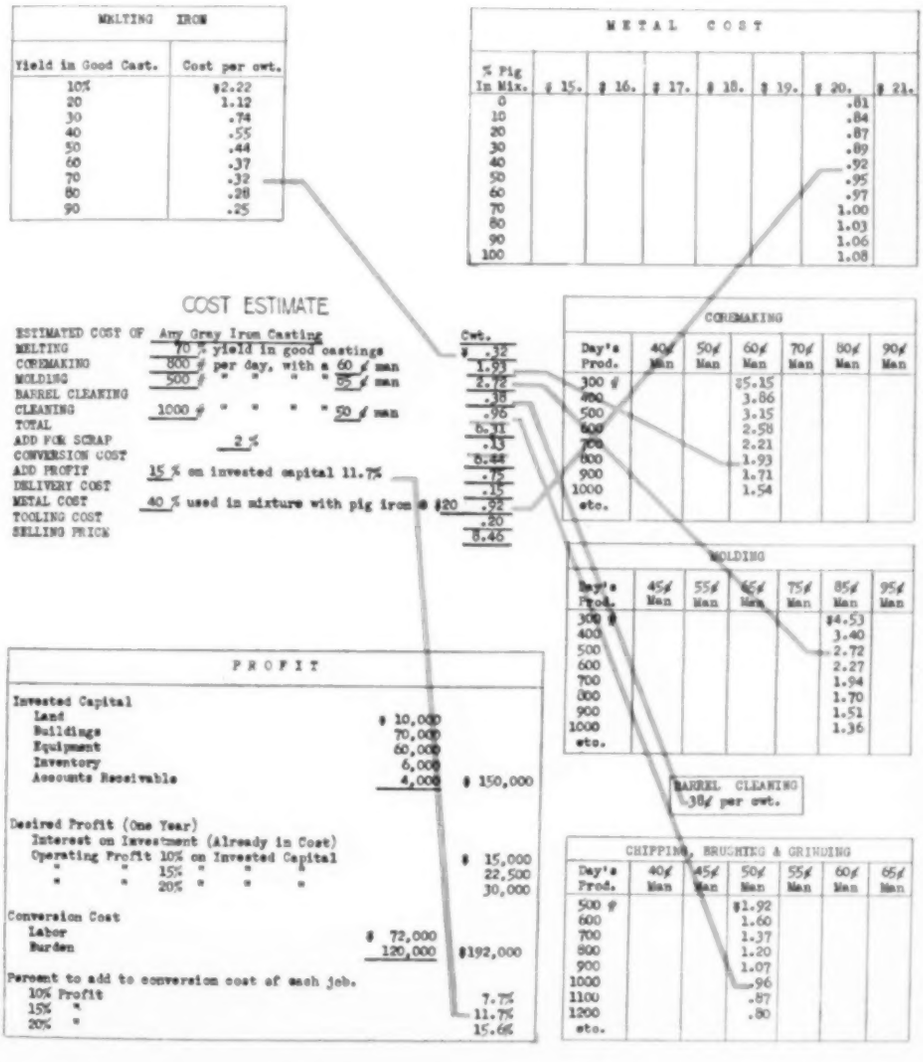
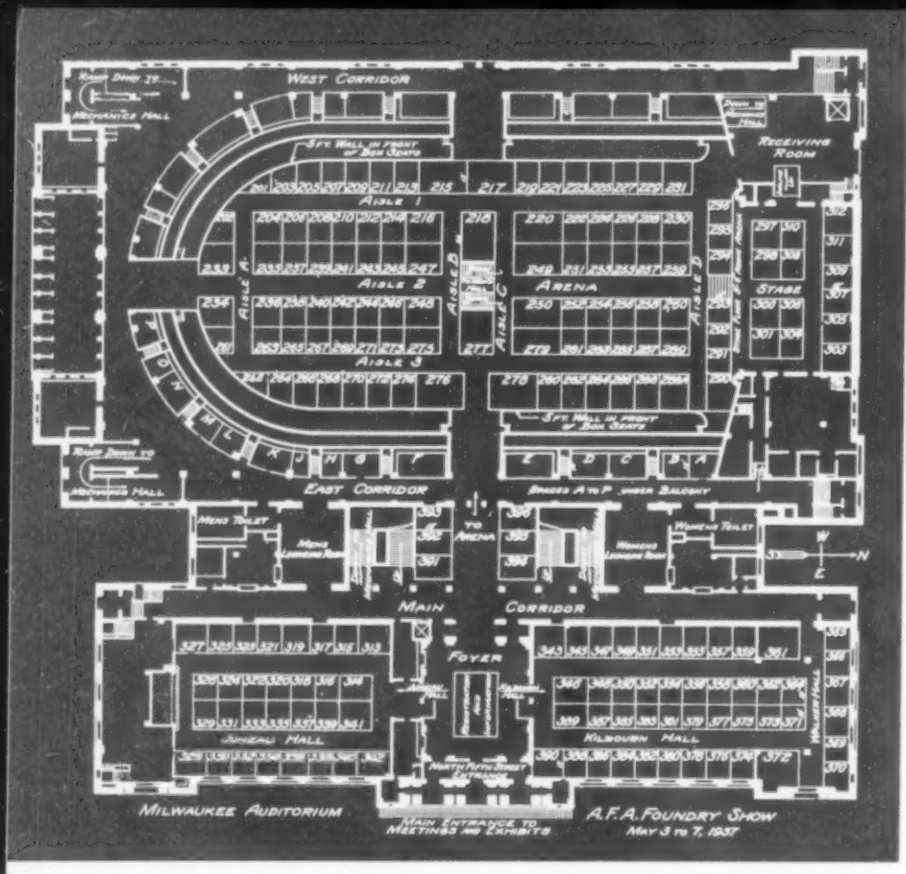


Fig. 3—Tables reduce clerical cost

Milwaukee Show Approaches Record



PLANS for the exhibition of foundry equipment and supplies in connection with the convention of the American Foundrymen's association in Milwaukee, May 3 to 7, indicate a record breaking display.

With more than 75 classifications of machines and materials presented by nearly 200 firms, a greater variety of interest will be offered than at any previous show held in connection with the annual meetings of the association, according to a report from headquarters in Chicago. In number of exhibits, the show will exceed the Detroit exhibition held in 1936. Although the facilities available have limited to some extent the size of a few individual displays, the total space occupied will be greater than in 1918 and 1924, the two previous years when foundry exhibitions were held in Milwaukee.

Manufacturers are selecting the newest of their lines of products and concentrating upon the educational advantages which this show will afford to foundrymen who use this oportunity to scan, study, compare, and acquire those items of equipment or supplies to meet their urgent needs.

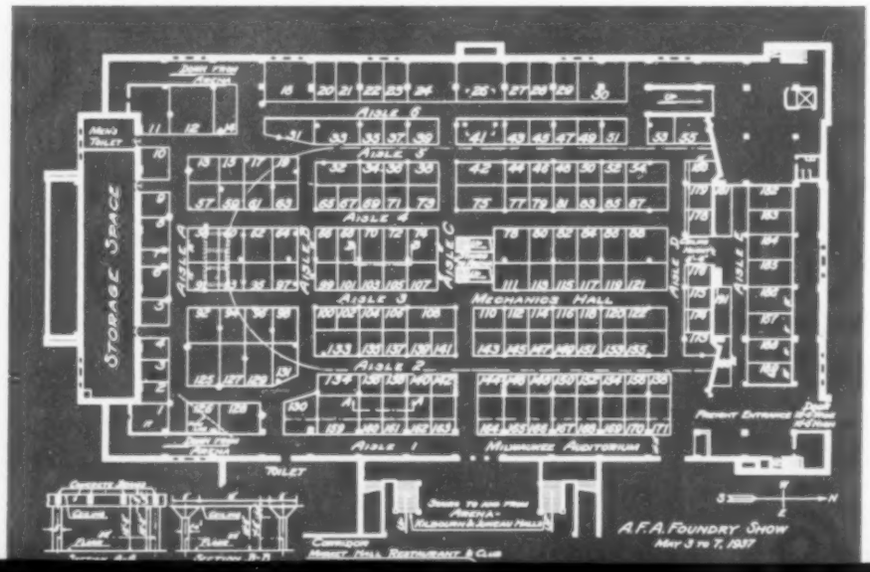
The complete facilities of the Milwaukee auditorium will be utilized. These include the Main arena, Juneau, Kilbourn, and Walker halls on the upper level and Mechanics hall on the lower floor. The latter will be devoted to operating exhibits demonstrating the practical use of various types of machinery. Particular attention is being given by exhibitors this year to setting forth operating economies in molding, coremaking, melting, handling and conveying, and cleaning operations.

Realizing the situation created by a shortage of man-power, these aids to production and labor saving afford a most valuable active demonstration for the entire foundry industry. Emphasis also is placed upon plant housekeeping, ventilating, lighting, and all those factors contributing to make the individual foundry a more attractive place in which to work.

A point of significance underlying the plans of exhibitors of the 1937 show is a definite interest manifested in machinery replacement. Plant extension, the replacement of out-of-date machinery, and new plant construction, have served to stimulate equipment builders. In consequence the foundryman visiting the exhibition at Milwaukee may evaluate his own present facilities and learn of new equipment and materials affording definite operating economies.

With all of the wide range of activities afforded by the combined convention and exhibition, full opportunity will be given to visitors to study the exhibition in detail. The opening hour for the exhibition has been set for 1 p. m. Monday, May 3, and the exhibition halls will remain open until 10 p. m. that night. On all other days, the hours will be from 8:30 a. m. to 5 p. m. with the exception of Friday, May 7, when the exhibition closes at 1 p. m. (*Please turn to page* 78)

Upper Left—Floor plans of Main arena, Juneau, Kilbourn, and Walker halls on upper level. Below—Booth arrangement for Mechanics hall on lower floor



Runner Basin Is Set Above the Mold

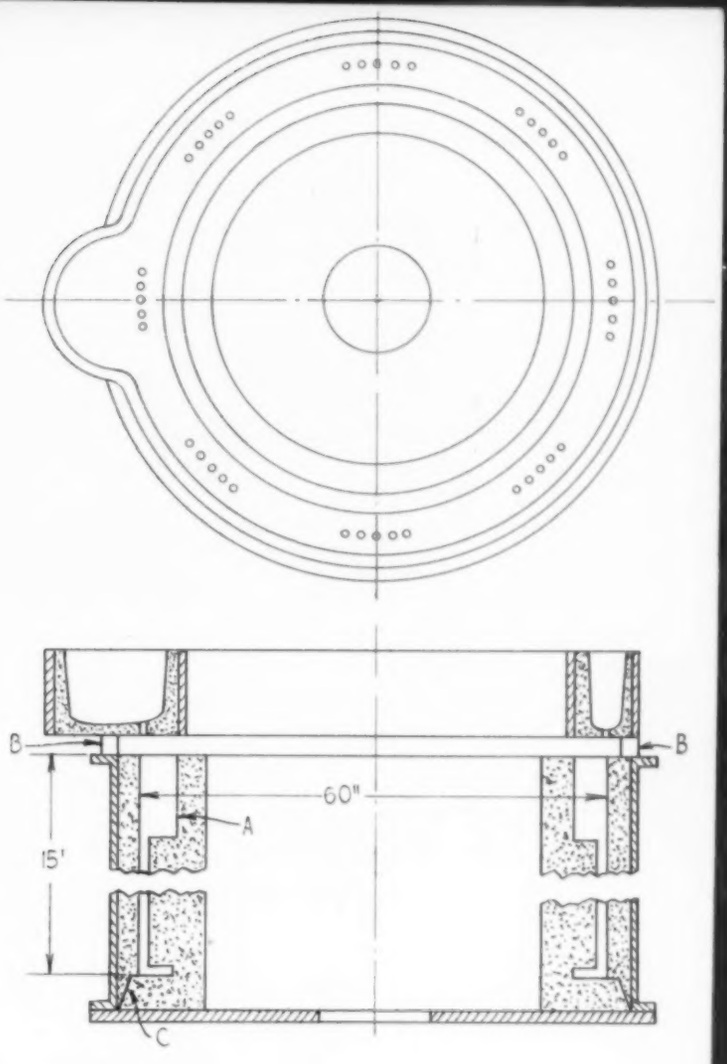
OWING to the comparatively limited field in which they are used, the demand for dryer shells, and paper making machines of which they form an important part, is not so extensive as in the automotive, transportation, mining, agricultural or any of several other major industries in which castings play such an important part. Consequently the manufacture of these dryer shells, long, hollow cast iron rolls, is confined to a small number of foundries. Naturally over a period of years a special technique has been developed for their production. The castings range in size from 1 to 5 feet in diameter and from 6 to 27 feet in length. Thickness of the heaviest wall is not much more than an inch.

Metal Should Be Clean and Solid

Specifications for one of these castings are rather exacting. Tensile and transverse strength are not the most important factors, although the iron designed to meet the other requirements automatically shows fairly high strength in both these particulars. The most important feature in one of these castings is that the metal shall be clean and solid throughout, capable of resisting steam pressure and of finishing to a polished surface.

Considering the many theories held on the proper manner of introducing metal into a mold and further theories on the behavior of metal in a mold, it is interesting to note that the practice developed by the cast iron pipe makers, a practice regarded as standard over a long period of years, has been found the most satisfactory of any method attempted in gating and pouring dryer shell castings. The mold is set up on end and the metal from a circular basin drops into the mold through a number of small pop gates. The method is simple, it is economical since no iron remains in the basin or gates, it is self skimming, it fills the mold uniformly, it promotes the theoretical condition, progressive freezing of the metal from the bottom and consequently reduces the static pressure against the wall in the lower parts of the mold. Briefly, the method produces clean, solid castings and that feature in itself is sufficient commendation in the eyes of any foundryman, irrespective of any accompanying merits or demerits.

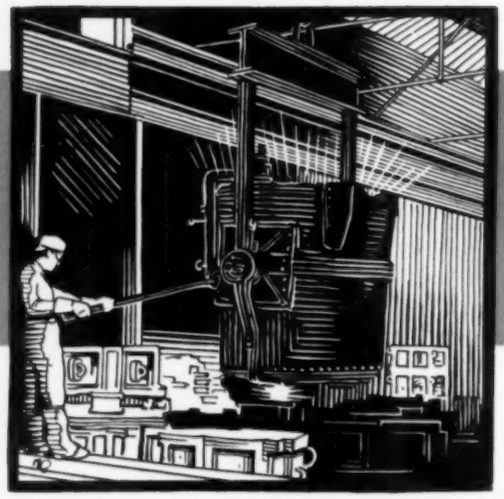
Local conditions and to some extent personal preference of some individual in authority, usually decide



Sketch showing runner basin in position above the mold. Principal dimensions of mold are included

whether the molds and cores shall be made in dry sand or loam molds. In service the shells are supported by a hollow gudgeon or shaft at either end resting in suitable bearings. On the smaller sizes these gudgeons form an integral part of the casting. The larger sizes are cast open with an internal flange at either end. Later, in the machine shop the flanges are faced and drilled for attachment of the ends, slightly domed circular castings with a gudgeon in the center on the outside. The lower internal flange is cast to size, but the upper flange, as shown at *A* in the accompanying illustration, is carried upward for from 10 to 12 inches to serve as a sullage head and feeder. This extra ring or head metal of course later is removed in the machine shop.

Molds for the smaller sizes are made in circular cast iron flasks of varying heights, machined parallel on both flanges. By suitable adjustment of the dryer shell pattern in the bottom section, it is apparent that the correct number of sections for any given length of casting may be calculated readily. Each section of the flask is placed around the pattern on a jolt machine, filled with sand, jolted, lifted off, blacked and placed on the oven car. In some instances several sections are built on top of each other while green and the joints slicked over. In other instances the joints are daubed (*Please turn to page* 77)



Questions and Answers

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Adding Chromium and Copper To Iron in the Ladle

We have an inquiry for some small castings which must contain not less than 1 per cent chromium and 0.25 to 0.35 per cent copper. Since these castings will be only a small part of our regular heat taken from a 42-inch cupola, it is not practical to make a special charge for the castings, and we would like to know how the alloys can be added. We have two small brass furnaces fired with natural gas, and we wonder if it would be possible to melt a small quantity of the alloys which would be added the regular pouring ladle.

If your cupola practice is such that your molten metal comes down extremely hot, we cannot see any reason why difficulty should be encountered which would prevent adding the chromium and copper in the ladle, provided that at least 100 pounds of molten metal forms the base for addition of the alloys. The procedure is to obtain ferrochromium ground to about 12 mesh size, and the copper either as shot or in thin sheet form or possibly as small size tubing. Approximately 26 ounces of 70 per cent ferrochromium and 6 ounces of copper will be required for 100 pounds of molten metal to provide 1 per cent chromium and 0.30 per cent copper in the final iron.

Get the ferrochromium as hot as possible—red hot—by placing it on a shovel and heating it by any convenient means such as holding it over the mixing ladle, over-iron pig beds, etc. Then the ladle in which the mixing is to be done is placed in front of the cupola and the bottom of it covered, say about a couple of inches or so, with molten metal. At that point, the red hot ferrochromium is brought over and allowed to slide off the shovel to the metal at the juncture of the cupola stream and the top of the molten metal. Addition of the ferrochromium should be gradual, and directing it to the juncture of the cupola stream and the metal in the ladle will insure the thorough and essential mixing.

When the ferrochromium is added, then the copper should be added, and the procedure will depend, of course, upon its form. If it is in the form of shot it should be added slowly with constant stirring of the bath to insure thorough incorporation. If the copper is in the form of sheets or tubing, it can be forced beneath the surface by attaching it to the stirring rod. The essential point in adding copper is to stir it thoroughly so that it goes completely into the solution.

While it would be possible to melt the copper and ferrochromium in your gas fired furnaces, we do not believe that the expense would be warranted due to the small quantities involved at any one time, and it almost would be necessary to maintain a definite quantity of each available all through the day as apparently you desire to pour the alloy castings at various times during the day.

Roll Composition Varies With Type of Cane

We have an order for some sugar mill crusher and mill rolls and will appreciate information on the required silicon and manganese content in these castings. The crusher rolls must be hard and tough while the mill rolls must have an open grain to prevent slippage of the cane. Formerly we have used a straight chilled cast iron wheel scrap mixture.

Sugar mill rolls present a peculiar problem that is not present in rolls employed for rolling other materials. In the present instance if the crusher rolls are designed for use on Louisiana cane and if they are of the herringbone type, they can be made satisfactorily from all car wheel scrap. Steel rolls have been found most satisfactory for Cuban or Porto Rico cane. Car wheel scrap will not make satisfactory mill rolls. The grain of the iron is too fine and will result in slippage. One

prominent manufacturer of these rolls finds a southern basic iron most satisfactory for the purpose. The analysis shows approximately: Silicon 0.80 per cent, phorphorus 0.70 to 0.80 per cent, manganese 0.50 per cent and sulphur under 0.05 per cent. This pig iron is quite brittle and in shipment and unloading is easily broken. However, the iron should not be judged on this feature alone.

For rolls, it is melted alone without any addition of other pig iron or scrap. The casting should be left in the mold for 3 or 4 days for self annealing. With suitable construction the flask may be removed to leave the sand surrounding the casting. Loam molds, of course, are not disturbed during this period. Tools for turning and contouring these rolls should not be sharp. They should be slightly dull so that they may do a little tearing. The foregoing is predicated on the assumption that the rolls are large. Smaller rolls for grinding sorghum, etc., are not so important.

Refining of White Metals Requires Experience

We desire to use some proportion of scrap which we can buy at a low price for our fabrication of white-metals. We would be obliged if you could indicate to us some chemical products for removing impurities from the scrap to obtain a sound metal. The white metals we use are composed of either about 24 per cent lead, 10 per cent antimony, 60 per cent tin and 6 per cent copper; or about 80 per cent lead and 20 per cent antimony.

Your inquiry fails to reveal what use is made of the lead and tin base materials. Some of the white metals in scrap form contain zinc as an impurity, which is detrimental for certain types of service. To remove this entirely is difficult but most of it can be removed by applying sal ammoniac to the bath of molten metal, stirring thoroughly and skimming and repeating this procedure until the zinc content is reduced. The sluggishness of white metals generally is due to the presence of oxides which may be reduced to some extent by the use of a deoxidizing agent, the intelligent application of which is necessary because one deoxidizing agent might prove more valuable in the case of one type of oxides whereas another would be preferable for the oxides of other metals. In the case of copper oxide, phosphorus is the preferred reducing agent, while with lead or tin oxide, phosphorus tin sometimes is effective.

It is the general practice of refiners of such metals to submit a bath of molten metal to repeated applications of resin and agitation, which will insure the melted resin to contact with the oxides as they float to the surface. From this discussion it will be noted that to clear up a bath of white metals, one should have the experience that is found in the smelters who make a business of recovering these white metal scraps. Buying scrap metal that looks satisfactory without knowing its chemical composition presents chances of contamination by extraneous or undesirable elements.

Describes Manufacture of Oilless Bearings

Will you please give us information as to what composition from which an oilless bronze bearing is made?

One method of making oilless bronze bearings is to turn spiral grooves in the bushing or drill small holes in the bushing and then fill the grooves or holes with a graphite paste which is baked in position. The other methods, which are similar except as to the form of the materials used, are proprietary processes, and involve the use of powdered materials, heat and pressure.

One process employs finely powdered copper, tin, lead and graphite in metallic form which are mixed together in the desired proportions and then placed in a mold or die, and subjected to heat and high pressure. The other process is quite similar except that oxides of the previously mentioned metals are used and a sufficient excess of graphite is employed to reduce the oxides to metallic form and still leave considerable graphite as such in the finished product.

Still another method which might be employed for producing such bearings although they hardly could be termed bronze, involves the use of a thin graphite shell or tube around which the backing metal is poured. In that, usually a metal mold is employed and as soon as the metal solidifies, the casting with its graphite face is dropped into a bucket of lubricating oil. The oil of course penetrates into the pores of the graphite shell.

It is our impression that the latter two types of bearings are used only for small jobs such as in small motors, small automotive bearings, washing machines, vacuum cleaners ,etc. as they are comparatively fragile.

Metal Fracture Alone Is Not Sufficient Information

We are sending a section broken from a malleable casting which has been annealed. We have had drillings from this casting analyzed and reports showed 0.77 per cent silicon (retested), 0.066 per cent sulphur, 0.129 per cent phosphorus, 0.27 per cent manganese, and 1.01 per cent total carbon. How would you account for the appearance of the fracture of the sample sent to you in view of the analysis. We might say that the iron will stand fair twisting and bending, and when it finally breaks, it goes with a snap.

No one can diagnose troubles adequately from looking at fractures. The total carbon suggests considerable decarburization but it is not stated how the sample was taken. No data on combined carbon are given so one can only guess that the white fracture was due to combined carbon. It might be due to intergranular brittleness of ferrite though the silicon and phosphorus are low for such a condition. The composition is not particularly abnormal unless there has not been great decarburization. Was chromium looked for? Only a guess is possible and that guess is that something unusual happened in the annealing furnace.

Soil Pipe Cores Cause Blows

We are making soil pipe castings up to 4 inches diameter and are having trouble with metal blowing from the cores. We shall appreciate your advice on the proper way to make the core, ramming of the mold, gating and risers, mixture and grade of iron.

Green sand cores for soil pipe are made by revolving a cast iron barrel in a pair of suitable end supports while a thin stream of sand falls from a hopper 3 or 4 feet above. The height of the hopper regulates the density of the sand, and since sand from various deposits varies to some extent in permeability and other characteristics, the proper height of the hopper only may be determined by actual experiment. The sand on the completed core must be sufficiently hard to resist the pressure of the iron, otherwise the casting will be over weight, and will be thicker on the bottom than on the top.

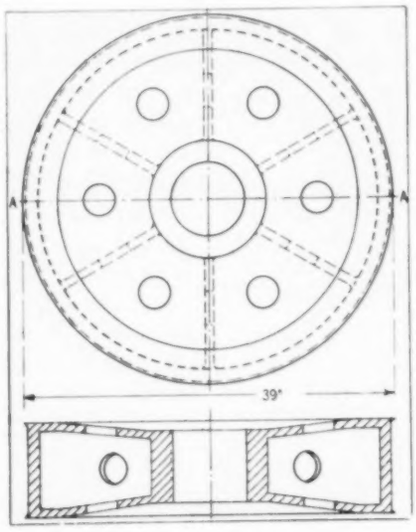
With some sands a single row of vent holes along the top of the arbor is sufficient. A small lug or other identifying mark on the end of the arbor shows where these vent holes are after the arbor is covered with sand and thus guides the molder in placing the core in the mold. Other sands are less open or permeable when rammed to the required density. In these instances the arbor must be vented to a greater extent. Sometimes an additional row of vent holes on the bottom is sufficient, while in extreme instances it may be necessary to vent the arbor all over the surface.

The vent holes may be drilled, but the ordinary practice is to form them on the core for the arbor with small tapered cores or with small tapered chills. Soil pipe molds are made two in a flask with a long runner extending from end to end in the center. Shallow gates are spaced about 3 inches apart. Four sprues in the cope conduct the metal to the runner. In some plants metal is poured into the four sprues simultaneously from four hand ladles, but in the majority of instances a special ladle with four spouts is employed. The ladle is suspended from a monorail and the molds are laid down in a straight line on rails or concrete strips.

Cope and drag of the flask are barred and no bottom boards are used. The sides of the flasks are tapered to reduce the amount of sand to a minimum. The iron must be melted and poured hot to prevent missruns and coldshuts. No risers are necessary. Any fairly soft, free flowing iron is satisfactory for these castings in which the approximate analysis is: Silicon 2.30 per cent, sulphur under 0.10 per cent, manganese 0.50 per cent, phosphorus 0.60 per cent. In southern irons the phosphorus is higher, but in this particular instance that is rather an advantage.

Stop Cracking Arms By Design Change

We are enclosing blueprint of a brake wheel for a well drilling machine. This wheel is subjected to an unusual strain in stopping tools and cable in a deep well. The strain is so great that the wheel becomes red hot and as a result the spokes crack. The casting is poured from an iron mixture of 75 per cent good machinery scrap and 25 per cent pig iron of the following analysis: Silicon 2.89 per cent, sulphur, 0.03 per cent, phosphorus 0.83 per cent, manganese 0.83 per cent. We shall appreciate your opinion on a suitable heat treatment, metal composition, change of design or any other factor that will prevent this casting from cracking in service.



Instead of arms the wheel is webbed or plated top and bottom

The unusual torsional strain coupled with the radical and intermittent changes in temperature constitute a severe strain on cast iron. For long continued service the wheel should be either all steel or a composite wheel, steel hub and arms bolted to a cast iron rim. The cast iron rim supplies the braking efficiency, while the steel spider and bolts supply the strength and the necessary elasticity to resist variations in diameter due to changes in temperature. The cost of this type of wheel naturally would be much higher than the plain type of wheel shown on your blueprint with flat curved arms reinforced by a rib in the center top and bottom of each arm.

If you are limited to a cast iron wheel we suggest the design shown in the accompanying illustration. The rim is connected to the hub by a plate or web top and bottom and six vertical arms as shown. In addition this type of wheel simplifies both patternmaking and molding. The pattern is a plain disk, while the interior of the mold is made up of six dry sand cores made from a single plain corebox. A circular print in the bottom of the box, a corresponding print held in place by a narrow strip attached temporarily to the top of the box, and a third print at one side of the box furnish bearings for disk cores which form the windows in the ribs between the cores, and in the top and bottom webs. The present composition of the iron is fairly satisfactory.

To Resist Pressure Under High Head

What metal thickness would you recommend for cast iron pipe flanged at both ends, 7 inches inside diameter with wood lining ½-inch thick to be used under 975-foot head. Kindly specify a suitable iron composition for these castings.

Water pressure in a pipe under a 975-foot head is 422 pounds per square inch, hence does not impose any undue strain on cast iron pipe of ordinary thickness and composition. From your statement we cannot decide definitely whether the pipe is 7 inches inside diameter, wood lined to 6 inches, or, 8 inches diameter lined to 7 inches. Assuming that the latter interpretation is correct the following dimensions and weights are given by a prominent pipe manufacturer: Standard length 12 feet, thickness of flange 1⅛-inch, wall thickness of pipe 0.90-inch, approximate weight per length 1000 pounds.

Approximate analysis of the iron for these castings will show: Silicon 2.00 to 2.20 per cent, sulphur 0.10 per cent maximum, phosphorus 0.30 to 0.70 per cent, manganese 0.50 to 0.70 per cent. However, your attention is directed to the fact that certain differences exist between pipes manufactured on a closely controlled production basis in a foundry specially designed and equipped for the purpose, and a general jobbing foundry where the same nicety and accuracy of detail cannot be observed.

Further, you probably intend to mold and cast the pipes in a horizontal position and this involves a possible slight shifting of the core with a resulting inequality in the wall thickness. For that reason it may be advisable to slightly increase

the given wall thickness. The greatest care must be taken to produce a mold and core that will not cause the metal to flutter in the slightest degree. If the metal *kicks* or *boils*, even to a slight degree it will produce defective areas in the casting. In many instances these defective areas are not visible upon casual inspection, but become quite apparent when the pressure test is applied. The most satisfactory method of gating the casting is through a row of seven, ½-inch diameter pop gates spaced about 12 inches apart on top of the pipe.

Test Bar Results Not Uniform

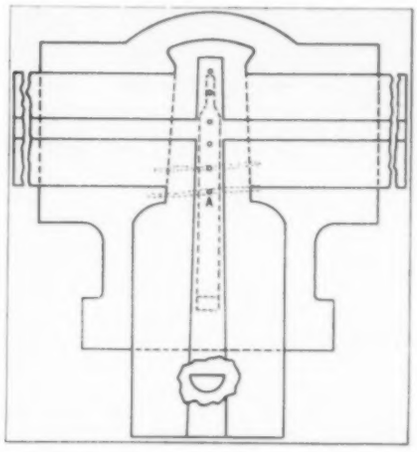
We are having considerable trouble in obtaining uniform results in using 50 per cent steel scrap. Our present mixture is composed of 50 per cent rail butts, 20 per cent returns (heavy), and 30 per cent pig iron containing 2.51 per cent silicon. In addition 0.4 per cent manganese and 0.05 per cent is added in the form of ferroalloy briquets. Our cupola is 42 inches in diameter, but we only use 500-pound charges as the coke is weak. The metal has to meet a specification calling for 1.2-inch test bars to sustain a load of 2400 pounds, and a deflection of 0.24-inch on 18-inch supports. Test bars are poured from one of the first five taps and from the ninth or tenth tap. The first bars are high in deflection and low in load, while the later bars are high in load and low in deflection.

One of the points that struck us as unusual in your inquiry, was the mention of using only 500-pound charges in a 42-inch cupola. You did not state how much coke you are using between charges, but if you have a melting ratio of between 1 to 7 or 8, only from 65 to 70 pounds of coke will be employed. In our opinion that is not sufficient to provide the best results in a 42-inch cupola. Assuming that your coke weighs 32.5 pounds per cubic foot (dense coke will weigh about 35 pounds per cubic foot), your present coke splits will occupy 2 to 2.15 cubic feet. A 42-inch cupola has an area of 9.62 square feet, so that the coke will be from 0.208 to 0.223 feet, or from 2.5 to 2.7 inches thick. According to the best practice, the coke should be not less than 4 inches thick.

Hence, we believe that you should increase your iron charges to 1000 pounds at least. If the coke will not support that load, it is advisable to obtain coke from another source. In melting steel scrap in such quantities as you are, use of a mixing ladle which will hold two charges is almost obligatory if uniform metal is desired. That permits good mixing of the various components of the charge even though one may melt a little faster than the other. Another point to watch is the height of your bed. Try it at about 36 inches above the tops of the tuyeres and note the results. Then raise or lower it until hot iron is obtained on the first tap.

Body of Valve Has Defect in Guide

We are enclosing photographs of a 2-inch cast steel valve body, sawed apart after machining to show a cavity in the valve stem guide. This defect appears only in the rib on the drag side of the casting. The rib is ½-inch high and ½-inch wide. The cores are oil sand and the castings are poured in pairs in dry sand molds.



View at joint of core showing position of vents

The defect in the internal rib of this valve body casting is a gas pocket and the cause is a core which either is too hard or one which is not properly vented. On account of this condition the metal flutters when it enters this rib in the core. Some of the gas escapes, but a sufficient amount remains trapped to form the cavity in one place, or several smaller cavities scattered over the top of the rib.

In all probability, if you were to saw the casting vertically through the center, you would find some traces of a defective area in the body metal immediately above the cope rib. The obvious remedy is to reduce the amount of binder to a minimum in the core. Dry the core almost to the point of burning, and run large vents through all three prints as shown in the accompanying illustration, a horizontal sectional view of the mold and core at the joint line. In addition to the vent passage in the drag and cope halves of the core, it may be advisable to run a few curved vents *A* in the pockets on either side of the internal rib as shown above.

Vanes for Cooling Do Not Run

We are making a small air cooled cylinder, weight about 60 pounds, vanes ⅜ to ⅝-inch, 1-inch deep. The molds are made in our regular core sand mixture bonded with linseed oil, well vented and dried thoroughly. The face of the mold is painted with graphite mixed with molasses water. Analysis of the metal shows: Silicon 1.80 per cent, sulphur 0.09 per cent, phosphorus 0.45 per cent, manganese 0.80 to 1.30 per cent. We have poured some of these castings in a vertical position with a row of small pop gates around the barrel. We have tried others in a horizontal position with a strainer core at the bottom of a sprue leading to a long runner and a number of shallow gates located near the bottom of the mold. The vanes are missrun and we find sand and dirt in the bore. The metal is hard and brittle in the vanes. Pouring temperature is between 2400 and 2500 degrees Fahr.

A possibility exists that the missrun vanes may be due to an excess deposit of blacking in the bottom of the narrow mold cavities. Unless the blacking is applied carefully and skillfully a large amount will collect in these places and occupy space that should be filled with the iron. In beginning your investigation you might check up on this feature. However, the most probable cause is cold iron and small gates. A temperature of 2400 to 2500 degrees is rather low for iron containing 10 per cent steel and 1.80 per cent silicon when poured in a small casting surrounded by a number of thin vanes. The pouring temperature should be nearer 2700 degrees.

The sprue and gates should be large enough to conduct the metal into the mold rapidly. The sand and dirt which appear in the bore may be due to one of two causes, or possibly a combination of both. 1—The sand may be washed from the pouring cup or the sprue. 2—The sand in the mold may not be sufficiently permeable with the result that the iron *boils* and dislodges particles of sand or blacking. Some of these particles float until they come in contact with the center core where they remain. Others float to the top. An otherwise satisfactory sand will develop this trouble if it is rammed too hard or if it carries an excessive amount of binder. Provide a large opening on top of a mold so that you may watch the behavior of the metal as it fills the mold. If it does not lie quietly, but bubbles in more or less violent commotion, you may accept that as evidence that the sand is not sufficiently permeable. The obvious remedy is to substitute a sand through which the gas may escape with much greater freedom.

N. C. MacPhee

J. Roxburgh

Alfred E. Gibson

S. S. Swasey

MEN OF INDUSTRY

J ROXBURGH, president of the Sheffield, England, branch of the Institute of British Foundrymen, is preparing the exchange paper which will be presented at the Milwaukee convention of the American Foundrymen's association. Mr. Roxburgh recently was appointed manager of the foundry and pattern shop of Davy Bros. Ltd., Sheffield, general engineer and manufacturer of rolling mill and steel works plant equipment, hydraulic and forging presses. He was born in Edinburgh and received his technical training from Birmingham university. He then worked in the foundries and pattern shop of the British Thomson-Houston Co., Rugby, and in 1924 was appointed assistant foundry manager, Brightside Foundry & Engineering Co., Sheffield. Two years later Mr. Roxburgh was made manager of the foundry and pattern shop, Newton Chambers & Co. Ltd., Chapeltown, a position which he retained until assuming his present duties. He is the author of numerous lectures and articles on technical subjects.

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NORMAN C. MACPHEE has been appointed metallurgist in charge of electric furnace operations for the Liberty Foundry Co., St. Louis. He formerly was associated with the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

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ALFRED E. GIBSON has been elected president of the Wellman Engineering Co., Cleveland, succeeding GEORGE W. BURRELL who becomes chairman of the board. Mr. Gibson graduated from Ohio State university in 1909 and entered the employ of the company in its operating department. He later became superintendent of its Cleveland plant, then general superintendent in charge of its Cleveland and Akron, O., plants. In 1926 he became associaed with the Fulton Foundry & Machine Co., Cleveland, as vice president, later being elected president. He returned to the Wellman company in 1928 as works manager and was appointed executive vice president in 1935. Mr. Gibson is president of the American Welding society and a member of numerous other associations. J. HARRY WARRINER has been appointed works manager of the company.

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GEORGE FURMAN, formerly associated with Beardsley & Piper Co., Chicago, has returned to that organization as sales engineer and is handling a part of its eastern sales territory in Pennsylvania and New York state. S. S. SWASEY has been added to the general sales engineering staff recently for consultation and engineering service in all territories. J. J. WALSH has been appointed to the company's staff as a demonstrator and will spend the majority of his time installing equipment.

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CHARLES E. MCQUIGG, research director since 1934 for the Union Carbide & Carbon Co., Long Island City, N. Y., will become dean of Ohio State university's college of engineering July 1. He is an alumnus of the university, graduating in 1909 as a mining engineer. Mr. McQuigg was born in Ironton, O. After his graduation he spent a year with the Santa Fe railroad and acted as assistant engineer of tests for the Anaconda Copper Co. For 5 years he was head of the department of metallurgy at Pennsylvania State college. Mr. McQuigg was with the research and development laboratories of the Electro-Metallurgical Co. for 2 years, after serving in the war. Since 1921 he has been with the Union Carbide company. He has served on committees in many important societies and associations.

• • •

PETER L. CONWAY has been appointed by Link-Belt Co., Chicago, to handle sales in the area immediately to the south of Chicago, including South Chicago and Gary, with headquarters in Chicago. MIKE J. PARYKAZA has been assigned to handle sales in the north central territory, comprising portions of Wisconsin, Michigan, Minnesota and South Dakota, and all of North Dakota. His headquarters will be in Chicago also.

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H. F. HENRIQUES and J. J. LINCOLN JR. have been appointed assistant general sales managers of the Air Reduction Co. Inc., New York, with headquarters in Cleveland and Pittsburgh, respectively. J. M. DRISCOLL has been appointed acting manager at Cleveland. S. D. EDSALL has been made acting manager of the Pittsburgh district. A. W. BROWN has been appointed assistant railroad sales manager with headquarters in New York. J. F. PRYOR, formerly assistant to the general sales manager, has been made vice president of the Magnolia Airco Gas Products Co., with headquarters in Houston, Tex.

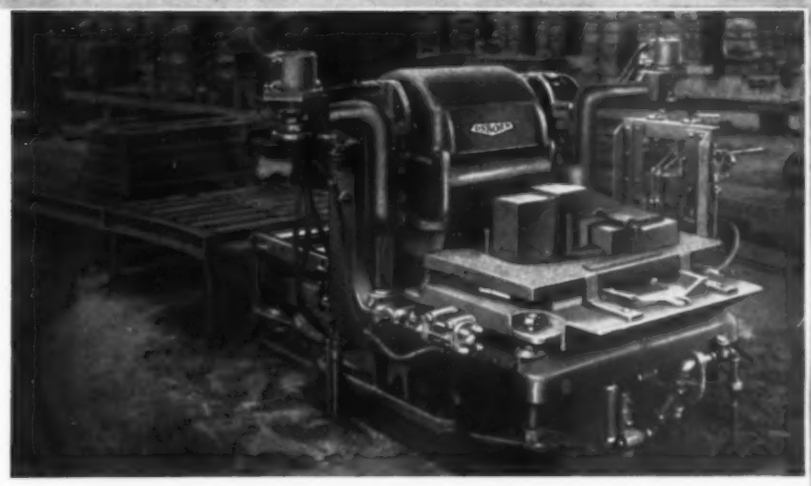
(Concluded on page 42)

OSBORN

MOULDING MACHINES

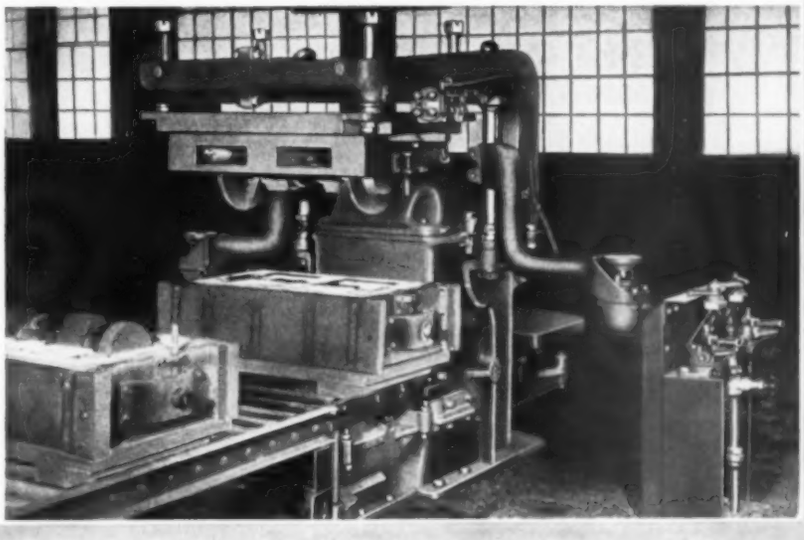
• Osborn Jolt Rockover Pattern Draw Moulding Machines are ideal for fast production of quality moulds in jobbing and semi-production foundries. The open-end type construction accommodates a wide scope of flask sizes and shapes. Adjustment from minimum to maximum draw stroke is quickly and easily made. Pattern draw operation is fast, smooth and accurate. Details of design, construction, operation and maintenance of these machines are engineered to keep moulding costs at rock bottom levels while maintaining highest standards of production. Check up on Osborn Jolt Rockover Pattern Draw Moulding Machines.

The Osborn Manufacturing Company
5401 HAMILTON AVENUE • CLEVELAND, OHIO, U. S. A.
• Agencies strategically located all over the world •



No. 243 Osborn Jolt Rockover Pattern Draw Moulding Machine in a foundry specializing in high quality alloy steel castings.

No. 243 Machine making moulds for intricate valve and pump castings in a gray iron foundry.



TIME PROVES VALUES

OSBORN

(*Concluded from page* 40)

BRUCE B. WALLACE has joined the staff of the Los Angeles office of the Foxboro Co., Foxboro, Mass., in the capacity of sales engineer.

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OTTO HARER, former president of the Light Alloys Co., Painesville, O., has been appointed aluminum castings sales manager of the Wellman Bronze & Aluminum Co., Cleveland.

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C. E. MILLIGAN has become affiliated with the Electro Refractories & Alloys Corp., Buffalo, in a special engineering capacity. He has been with the Aluminum Co. of America, Cleveland, since 1923.

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A. W. GREGG again is connected with the Whiting Corp., Harvey, Ill., and is serving in the foundry equipment sales division. At one time he was superintendent of the company's foundry department at Harvey.

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HOWELL C. CUNNINGHAM, secretary since 1912 of the Crucible Steel Casting Co., Lansdowne, Pa., has been elected vice president and treasurer. H. L. MCCLEES, associated with the company since 1918, has been elected secretary.

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E. S. BISSELL, formerly technical advisor on industrial application, Instrument division, Bausch & Lomb Optical Co., Rochester, N. Y., has been made sales manager of the Mixing Equipment Co., Rochester.

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J. B. BROWN recently was made steel foundry superintendent, Kilby Car & Foundry Co., Anniston, Ala. Mr. Brown formerly was foundry superintendent, Oklahoma Steel Castings Co., Tulsa, Okla. and prior to that was steel foundry foreman and foundry superintendent with the Walworth Co.

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O. J. GARTNER has been appointed assistant sales manager of the Steelblast Abrasive Co., Cleveland. He will assist E. L. BEISEL, sales manager, in Ohio, Indiana, Pennsylvania, Kentucky and West Virginia. New district representatives have been appointed as follows: CHARLES HILB, 909 Provident Bank building, Cincinnati, for southwestern Ohio; LAWRENCE M. RAISMAN, 4740 Sylvan avenue, Pittsburgh, for western Pennsylvania; and EUGENE W. ORNE, Central Steel & Supply Co., Chicago, for northern Indiana.

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EDWIN T. DODDRIDGE, Cleveland, has been made vice president of the Wm. Nicholls Co. Inc., Richmond Hill, Long Island, N. Y. Mr. Doddridge formerly was research and development engineer, the Osborn Mfg. Co., Cleveland.

Prior to the time he joined the Osborn organization in 1909, Mr. Doddridge was head of the pattern department of the Ferro Machine & Foundry Co., and one of the original Ferro foundry group which made many outstanding contributions to the progress and development of modern automotive foundries.

Edwin T. Doddridge

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C. M. HOUCK, formerly manager of the inspection division, Pittsburgh Testing Laboratory, Pittsburgh, recently was elected a vice president of the company. He formerly was associated with the Heine Boiler Co., St. Louis, and the UGI Contracting Co., Philadelphia. Mr. Houck has been affiliated with the Pittsburgh company for 6 years.

• • •

W. F. PERKINS, vice president in charge of the American hammered piston ring and Bartlett Hayward divisions of the Koppers Co. and its subsidiary, the Maryland Drydock Co., both in Baltimore, has been placed in charge of the company's Western gas division in Fort Wayne, Ind., which supplies the public works and manufactured gas fields. R. A. WICKES will continue as general manager of the division under Mr. Perkins.

• • •

R. B. RENNER, associated with the Jeffrey Mfg. Co., Columbus, O., for the last 30 years as mechanical engineer, recently has been made chairman of the executive committee, materials handling division, of the American Society of Mechanical Engineers. The function of this division is to co-ordinate and bring before the engineering public outstanding developments in conveying machinery and its use.

• • •

H. B. LOXTERMAN has been elected a vice president of the Blaw-Knox Co., Blawnox, Pa. ALBERT L. CUFF has been made secretary of the company. In addition the following officers have been elected to subsidiary companies: W. H. EISENBEIS has been made vice president of the Union Steel Casting Co., Pittsburgh, and JOHN BAKER has been made sales manager of that company. P. M. FLEMING has been appointed vice president and a director of the Pittsburgh Rolls Corp., Pittsburgh.

• • •

WELLES G. CATLIN, specialist in industrial production planning, has joined the staff of the personnel training division, International Correspondence Schools, Scranton, Pa. He will specialize in co-ordinating trade practices and the school's technical instruction, with a view to the development of mechanics and other personnel. Mr. Catlin is a graduate of Cornell university where he received his degree in electrical engineering. He has been associated with the American Car & Foundry Co., the Drybak Corp. and Shepard Niles Crane & Hoist Co. In 1932 he served as vice president of the Elmira, N. Y. Management association.

• • •

RUSSELL M. SCOTT recently has become connected with the foundry department of the Pontiac Motor Co. division of General Motors Corp., Pontiac, Mich. Mr. Scott was born in Walkerville, Ont., and was educated in the public schools and served his apprenticeship as pattern maker in the Cleveland Punch & Shear Works, After 2 years spent in various shops, Mr. Scott became connected with the Packard Motor Car Co., Detroit, in 1907. From that time until 1912 he worked at the bench as a pattern maker. In 1913 he was made general foreman, in 1920 assistant foundry superintendent and later foundry superintendent. In 1925 Mr. Scott was appointed foundry manager of the Packard Motor Car Co., Detroit.

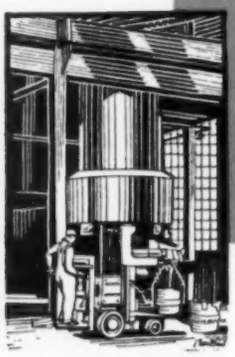
The Scene Changes

. . . and traditional pattern is eclipsed to advance the *greatest improvement* in Roller Conveyer design since its inception. • To be formally announced in the April number of the FOUNDRY—and exhibited in operation at the AMERICAN FOUNDRYMEN'S CONVENTION in Milwaukee.

MATHEWS CONVEYER COMPANY

104 TENTH STREET, ELLWOOD CITY, PA.

MATHEWS CONVEYER CO., LTD., Port Hope, Ontario, Canada • MAILLER SEARLES, INC., San Francisco, Calif.



VIEWING FOUNDRY DEVELOPMENTS

At Short Range

ONE thing that all foundrymen should keep in mind is that the designer of a casting is not interested so much in the cost per pound of the casting material as he is in the overall cost of the finished casting which will suit his requirement best. A decrease in cost often may be accomplished by a decrease in weight obtained by choice of proper design, proper selection of casting material (possibly, although not necessarily, through the addition of special alloys), and proper heat treatment. In other cases the choice of proper design even may mean slight increases in the weight of castings, but a lower pound piece price.

♦ ♦ ♦

One of the leading molding machine manufacturers uses a nickel-chromium-molybdenum cast iron for the jolt piston and head frame of its large molding machines. Some idea of the size of the machine may be gained by stating that the jolt piston weighs 1100 *pounds. The alloy used has the following range of composition: Silicon,* 1.50 *to* 1.70 *per cent; manganese,* 0.65 *to* 0.85 *per cent; phosphorus,* 0.20 *per cent maximum; total carbon,* 3.00 *to* 3.10 *per cent; nickel,* 0.80 *to* 1.00 *per cent; chromium,* 0.20 *to* 0.30 *per cent, and molybdenum,* 0.55 *to* 0.70 *per cent.*

♦ ♦ ♦

New cement intended to replace glue in setting-up polishing wheels, disks and belts, is supplied in liquid form in three different consistencies. It will air set in 24 hours, but can be force-dried in 2 hours. Water is used to wash it off.

♦ ♦ ♦

Warpage characteristics of alloy cast irons are similar to those of plain cast irons. The degree of warping usually is a function of design and may be lessened only by pattern changes or changes of gating locations. In some cases it is necessary to warp the patterns to get a straight casting. In general, warpage is influenced by cooling rate and it is possible to eliminate the trouble by holding the casting in the sand until completely cool. Pouring rate also has a marked influence on the tendency to warp, and warping sometimes is eliminated by readjustment of entrance gates in the casting.

♦ ♦ ♦

A Midwestern pipe-fittings manufacturer is employing multiple coreboxes for coreblowing machines, made of an alloy cast iron containing 14 per cent nickel and 7 per cent copper because of their high resistance to sand abrasion and to corrosion from caustic soda solution which is used to clean them.

♦ ♦ ♦

WHEREVER possible, surfaces of castings to be machined should be cast in the drag side of the mold. If cast in that position, there is less chance of those surfaces containing defects such as shrinkage, slag and blowholes than if they are cast in the cope side of the mold. Where finished surfaces must be cast in the cope, an extra allowance for machining must be made.

♦ ♦ ♦

A newly developed rubberizing compound is said to eliminate the need for a separate primer. The compound is used as an insulator, waterproofer, and protector against corrosion by alkalies and mild acids. The product is said to make a good bond in one application, and is self-curing. It may be applied by dipping, spraying or by hand brushing. Vulcanizing period is one hour between coats if more than one is employed.

♦ ♦ ♦

Indiscriminate use of scrap caused difficulty in the manufacture of bronze catenary clips used in suspending overhead wires in electric railroads. The castings cracked when tightened up showing that they lacked the necessary ductility. As a result an alloy comprised of 88 per cent copper, 5 per cent tin, 5 per cent nickel, and 2 per cent zinc made from quality materials was selected for manufacture of the clips.

♦ ♦ ♦

ANALYSIS of a large alloy cast iron die weighing 20,000 pounds, and designed for use in an automotive shop is given as: Total carbon, 3.06 per cent; silicon, 1.30 per cent; phosphorus, 0.15 per cent; manganese, 0.32 per cent; nickel, 3.22 per cent, and chromium, 0.84 per cent.

♦ ♦ ♦

Highest physical properties of a 3½ per cent nickel steel (S.A.E. 2335) are obtained through a double normalizing and tempering heat treatment. That treatment involves heating to 1750 to 1850 degrees Fahr.; holding for 1½ hours per inch of maximum section; cooling in air; reheating to 1525 to 1575 degrees; holding 1 hour per inch of section; cooling in air, and drawing at 1200 degrees Fahr.

♦ ♦ ♦

Extensive tests on a variety of materials for worm gears indicate that a chill-cast nickel-phosphor bronze ranks first in resistance to wear and deformation. Best results were obtained with an alloy containing 87.5 *per cent copper;* 11 *per cent tin;* 1.5 *per cent nickel, and* 0.1 *to* 0.2 *per cent phosphorus.*

♦ ♦ ♦

Truck side frames and bolsters cast from pearlitic-manganese steel for a Brazilian railroad permitted a weight reduction of approximately 36 per cent. The old type of the built-up arch bar trucks weighed approximately 5500 pounds per car while the new cast type weigh approximately 3500 pounds. The typical analysis of the steel is 0.28 per cent carbon, 1.40 per cent manganese, and 1.40 per cent nickel.

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European Foundry Practice

Digest of Recent Literature Covering Various Phases of Castings Manufacture

Auto Castings

Cast Iron and the Automobile (La Fonte et l'Automobile), by Raymond Chavy. *La Fonte*, Paris, October, 1936.

Properties required from cast iron for various parts of an automobile chassis differ with the functions of these parts. The author reviews the particular conditions under which the various parts operate and describes characteristics necessary to obtain from the iron in each case, and the particular types and grades of iron that can fulfill these conditions. This review is concerned mainly with French practice, but reference also is made to certain aspects of British and American practice.

Taking the various parts of a chassis and engine, the following indications are given concerning the types of cast iron giving satisfaction:

For cylinder blocks, ordinary or special pearlitic irons have most of the required characteristics; different compositions are available for different sizes of blocks having thin or thick walls. Many manufacturers use alloy cast iron, and a type used both in America and in France contains 1.2 to 2.0 per cent nickel and 0.3 to 0.8 per cent chromium, with carbon 3.0 to 3.4 per cent, silicon 1.7 to 2.2 per cent, manganese 0.8 to 1.0 per cent and phosphorus 0.3 to 0.8 per cent. The author suggests, for cylinder blocks cast separately from the gear case, an iron having a martensitic structure after heat-treatment, with a high content of graphite.

For cylinder liners a different iron is required, whether the liner is in contact with the cooling water of the engine or not. For dry liners, an approximately pearlitic iron with 3.2 per cent carbon and 2 per cent silicon is satisfactory. Liners can be obtained by centrifugal casting, or by casting in dried-sand molds. The author is of the opinion that fine graphite is not desirable for these parts, but that an iron with high graphite content and the graphite in large flakes is better, because when the graphite is eliminated through wear, it leaves microscopic grooves which retain the lubricating oil. Liners also are made with Ni-Cr or Cr-Mo irons: some are made with Ni-Cr iron heat-treated to a martensitic structure, or with nitrided iron. It is stated that striking results have been obtained in Great Britain with Ni-resist iron.

For wet liners, a variety of alloy irons is used, but the author suggests either irons heat-treated to a martensitic structure treated after machining, or an original martensitic iron with sufficient special additions to render it machinable after annealing.

Piston rings either are taken from a cylinder or cast singly in multiple. The cylinders are either spun, in which case they have a fine graphite, or they can be cast in sand molds, in which case the composition of the iron is similar to that used for blocks. For rings cast singly, the following composition is given as an example: Total carbon 3.4 to 3.8, silicon 2.5 to 3.0, Mn 0.6 to 0.8, P 0.40 maximum. Nickel sometimes is added. In England, some piston rings are made with Ni-Mo, or Ni-Cr-Mo iron treated to a martensitic structure. Lately, tests have been made with an austenitic iron containing Ni, Cu and Cr: this iron is corrosion-resisting.

For cylinder heads an iron of a composition similar to that used for blocks will do: However, these parts must be susceptible of yielding to heat, and the modulus of elasticity should be relatively low.

Low phosphorus iron with relatively high carbon and silicon is used for exhaust manifolds. White iron with 2 to 3 per cent chromium and about as much molybdenum is used for valve seats. Gray Ni-Mo iron for camshafts. For brake drums, gray pearlitic iron is satisfactory: French manufacturers of automobiles add small percentages of Ni, Cr or Mo.

Dealing with crankshafts, the author refers to Ford practice. He mentions that other makers are trying gray irons with 2.5 to 2.8 per cent carbon, 2 per cent silicon and additions of Ni, Cr and sometimes Mo: Such crankshafts are usually heat-treated. The author makes suggestions relative to other automobile parts that could be made from gray cast iron if so desired.

Wear Resistance

The Wear of Iron Alloys by Minerals (Ueber den Verschleiss von Eisenlegierungen auf mineralischen Stoffen), by E. Knipp, *Die Giesserei*, Duesseldorf, Germany, January 15, 1937.

The author points out numerous methods of determining metal to metal wear have been developed, and but little on wear of metals by mineral substances. While some few testing methods have been developed they possess serious disadvantages. He describes a new method using a burned magnesite brick as the abradant. That is mounted on the face plate of a lathe while the metal in the form of a rod about $\frac{5}{8}$-inch in diameter acts as the cutting tool. The square end of the metal specimen forms an angle of 45 degrees with the face of the brick which rotates at 40 revolutions per minute. The feed is approximately 0.2-inch per minute and the duration of the test 3 minutes.

Results carried out on cast steel specimens show that increasing manganese and carbon increase resistance to wear in both annealed and hardened steel. With hardened steel the wear resistance is considerably increased over that for the annealed; roughly about 40 per cent. With annealed specimens change of carbon has a greater effect while with hardened specimens increase of manganese exerts the greatest effect. With pure martensitic steels change of carbon or manganese apparently has little effect on wear resistance.

Additions of molybdenum up to 1 per cent in annealed steels of different carbon and manganese contents decreased wear resistance, and the effect was independent of the carbon and manganese contents. Chromium increases wear resistance considerably, and exhibits the greatest effect in a steel containing 0.1 per cent carbon and 0.3 per cent manganese at 1 per cent chromium; in a steel containing 0.3 per cent carbon and 3 per cent manganese at 0.5 per cent chromium. In concluding the author points out that with a different abrading mineral that the results might be different, even to the point of a complete reversal and definite tests are required for each case.

Birmingham Chapters Stage Joint Foundry Meeting

ATTENDANCE at the fifth joint foundry practice meeting, held Feb. 25 and 26 at the Tutwiler hotel, Birmingham, Ala., under the sponsorship of the Birmingham District Chapter of the American Foundrymen's association and the Birmingham Section of the American Society of Mechanical Engineers, exceeded 400. Three technical sessions, a plant visitation program, a luncheon and a banquet featured the program.

The morning session on Thursday Feb. 25, was devoted to a paper "Reclaiming, Conditioning and Handling of Foundry Sand", presented by Lester B. Knight Jr., National Engineering Co., Chicago. J. E. Getzen, American Cast Iron Pipe Co., Birmingham, acted as chairman. Mr. Knight discussed in detail his paper, which was submitted as the exchange paper of the A.F.A. to the French Foundry Technical association in 1936, and was presented in part in the October, 1936 issue of THE FOUNDRY.

Discussed Various Features

The speaker discussed such variables as permeability, bond, moisture, strength and inert fines, and dealt with the limit to which they should be controlled. Mr. Knight pointed out that only recently work has been undertaken with reference to inert fines. He stated that each time metal is cast in sand, a certain amount of clay or bond is dehydrated, or partially dehydrated, some of the sea coal burned to ash and some of the silica grains fractured. This fine material is inert, has no bonding quality, and decreases permeability and causes rough, dirty castings with excessive burning on of the sand. Methods by which the inert fines may be removed and controlled were discussed in detail, together with the results obtained by mulling sand.

In conclusion the speaker stated that equipment alone does not make the necessary savings in sand control work. It is the proper use of the equipment, as applied to the particular problem, which justifies the capital expenditures for modern, up-to-date sand conditioning, reclamation and control machines.

In opening the discussion, H. L. McKinnon, C. O. Bartlett & Snow Co., Cleveland, mentioned the use of the pug mill in conditioning sand.

Dan M. Avey, secretary-treasurer, American Foundrymen's association, Chicago, was the guest speaker at the luncheon on Thursday noon, at which T. J. Carpenter, Republic Steel Co., Birmingham, presided. Mr. Avey's address is presented on page 25 of this issue of THE FOUNDRY.

Four papers dealing with the subject "Sand Handling in Local Foundries" were presented at the afternoon session with Charles B. Saunders, Tennessee Coal, Iron & Railroad Co., Birmingham, as chairman. W. Lee Roueche, McWane Cast Iron Pipe Co., Birmingham, discussed "Sand Handling Equipment from the Standpoint of the Foundryman as It Concerns the Mechanical Engineer". Mr. Roueche stated that the foundryman may expect his sand handling equipment to have ample capacity, provide proper separation of the sands, give continuity of operation, and develop minimum operating expense. The following suggestions were made to the mechanical engineer about to design a sand handling system: Determine the characteristics of sand to be handled; determine the hourly capacity needed; use totally enclosed motors of sufficient power; use antifriction bearings wherever possible; totally enclose gear reducers; pitch chutes for tempered sand not less than 60 degrees; design elevators properly; provide ample bypassing facilities for recirculating sand; etc.

Sand for Centrifugal Casting

In the second paper of the session, J. A. Woody, American Cast Iron Pipe Co., Birmingham, discussed "Distribution and Control of Sand for Centrifugally Cast Pipe". Mr. Woody described in detail the sand system used at his plant. He stated that sand travels a distance of approximately 460 feet from the shakeout to the ramming station. The entire system is operated by seven men. The speaker pointed out that considerable time was required to perfect the mixture and conditioning of sand that would stand the abuse of centrifugal casting. He stated that the machinery and method described and now in use enable the company to control the sand and make a good casting with a remarkably low loss.

W. W. Hairston, Stockham Pipe Fittings Co., Birmingham, discussed "Some Aspects of Sand Control for A Continuous System Using Squeeze Machines and Making Small Pipe Fittings". Mr. Hairston described briefly the foundry and its equipment, the routine followed in making the molds, methods of sand preparation and sand control, and the characteristics of the sand used. He stated that the sand employed is a semisynthetic mixture with approximately 70 per cent sharp sand with artificial bond, and 30 per cent natural bonded sand. To maintain a system, sand batches of new sand, reclaimed sand, sea coal and bond are mulled at least 4 minutes in a muller. These additions are added to the return sand just before it enters the bucket elevator on its way to the vibrating screen. The routine is such that new additions are fed through the entire duration of the shift. The speaker stated that this type of sand permits the permeability, moisture, and green and dry strengths to be maintained easily and eliminates the disposal of excess sand, and that it improves the surface of the castings produced.

Sand Used in Steel Foundry

In the last paper of the session, Harry Lee, Tennessee Coal, Iron & Railroad Co., Birmingham, discussed the type of sand employed and the equipment used in the steel foundry of that company. The greatest proportion of silica sand used is obtained on the property of the T.C.I.&R.R. Co. This sand is 85 per cent silica. Because of fineness, the company has developed a blend which contains 50 per cent of the previously mentioned sand, 25 per cent building sand having 98 per cent silica, and 25 per cent reclaimed foundry sand. Sand is stored in a hopper having a capacity of 500 tons. Two muller type mixers are used for making facing and core sand. Part of the molds in this foundry are made on machines and the remainder, which includes the larger castings, are made on the floor. All molds are skin dried.

Friday morning, Feb. 26, was devoted to an extensive plant visita-

(*Concluded on page* 50)

Ohio Ferro-Alloys Corporation
Canton, Ohio

(*Concluded from page 48*)

tion program under the chairmanship of J. A. Woody, American Cast Iron Pipe Co. This was followed by a complimentary luncheon, with the Woodward Iron Co., Birmingham, as host.

"Safety and Hygiene in The Foundry" was discussed in some detail at the 2 o'clock session by Dan M. Avey. S. D. Moxley, American Cast Iron Pipe Co., presided. Mr. Avey described the various activities of the Safety and Hygiene section of the American Foundrymen's association, especially as it pertains to the silicosis problem. He pointed out that the cost for proper protection and suppression equipment need not be excessive and that dust should be controlled at its source. At the present time, education in connection with the silicosis problem is a necessity.

Mr. Avey stated that dust counts should be used only as bench marks. If they are to be established as tentative standards, the industry should be given the opportunity of meeting them before they are even mentioned in the codes. The speaker then discussed the second national silicosis conference held recently in Washington, and touched upon the most important aspects of the engineering report presented at that conference. He also presented information on the insurance phases of the silicosis problem and described the work the association has done in connection with insurance matters. Considerable discussion followed the presentation of the paper.

At the final technical session with George R. Ozley, Alabama Byproducts Co., as chairman, Walter A. Meyer, Allis-Chalmers Mfg. Co., Milwaukee, dicussed "V-Belt Drives in Foundries" and "Enclosed Fan Cooled Motors". The speaker pointed to the foundry changes necessary with the introduction of the V-belt, discussed the advantages and listed the applications of that type of drive in the foundry industry.

In the second paper, "Architectural and Engineering Features of Foundry Buildings" Paul Wright, Paul Wright Co., Birmingham, illustrated several types of buildings for foundry work. He stated that factors of importance include the proper floor level, proper work area and size, ventilation, lighting and the necessary facilities for the proper movement of material.

In the final paper, J. M. Ketch, General Electric Co., Cleveland, dealt with "Industrial Lighting". Mr. Ketch discussed the primary consideration of proper lighting, and illustrated with several types of light, the results which can be obtained. He stated that workmen are paid for setting machines to the best advantage for operation, and that the only way a workman can see is through the lighting facilities provided by the employer.

The annual banquet, held at the Tutwiler hotel, Friday evening, was exceptionally well attended. L. N. Shannon, Stockham Pipe Fittings Co., and chairman of the Birmingham District Chapter of the A.F.A., presided and Karl Landgrebe, Tennessee Coal, Iron & Railroad Co., acted as toastmaster. A. M. MacCutcheon, Reliance Electric & Engineering Co., Cleveland, and president of the American Institute of Electrical Engineers, was the guest speaker.

Tells Chicago Group About Cores

L. P. Robinson, Werner G. Smith Co., Cleveland, discussed various phases of core room practice before the monthly meeting of the Chicago Chapter of the American Foundrymen's association, Feb. 8. About 125 members attended. P. S. Richardson, Crane Co., Chicago, acted as technical chairman.

Mr. Robinson indicated the different factors which enter into the production of suitable cores and gave suggestions as to means of eliminating the variables commonly present. He emphasized the importance of using the type of sand best suited for the quality of core required and the type of metal being poured.

The ratio of sand to oil should be fixed and not varied according to the whims of other departments of the foundry. Proper mixing is essential to the production of good cores, the speaker pointed out. This applies to the time of mixing as well as to the method. Machines have a distinct advantage over hand mixing, but trials are necessary to determine the proper length of mixing period.

Moisture constitutes another variable, but the latter may be corrected by drying the sand before using it. Variations in moisture result in similar distortions in the sand ratio. Core oven temperature should be controlled closely since underbaked cores will produce gas in the mold.

Atmospheric temperature and humidity have a certain effect on core room operations and should be taken into consideration to keep the amount of oil used and moisture content of the sand constant. One recommendation in later discussion was to weigh the oil, thereby eliminating variations in volume occasioned by differences in temperature.

One of the most important and one of the most frequently neglected phases of good core room practice is inspection, according to Mr. Robinson. Careful checking of each core before using will do much to eliminate bad castings.

Speaking before the nonferrous group of the Chicago chapter, H. Hagemeyer, vice president, Universal Castings Co., Chicago, described the process his company has developed for producing nonferrous castings in plaster molds.

Castings made by this process are said to have an accuracy comparable with that of die castings and are adaptable to quantity production of a wide range of parts made in alloys of aluminum, brass and bronze. The mold material consists of gypsum and water, mixed by jolting in a special water-tight flask. Following a short setting period, the mold is lifted from the pattern by a suction machine and inserted in a continuous dehydrating oven. Following the dehydration, the parts of the mold are assembled and poured as in ordinary foundry practice.

Gating and shrinkage problems are somewhat different from those encountered in sand castings, yet they present similar difficulties. Mr. Hagemeyer exhibited a large number of sample castings and molds which showed the possibilities of making castings of machined accuracy.

Book Review

La Malleable, by Maurice Leroyer, paper, 6¼ x 9¼ inches, 227 pages, published by Duned, Paris, France, and supplied by THE FOUNDRY, Cleveland, and in Europe by the Penton Publishing Co. Ltd., London.

This volume, which is in French, deals with the metallurgy of malleable cast iron and covers white heart, black heart and pearlitic malleable types. The book is divided into 9 chapters of which the first relates the past history, present state and future possibilities of malleable cast iron. The second discusses the theory of malleabilization while the third describes the influence of chemical composition on its founding properties, on graphitization and decarburization characteristics, and on physical properties.

Chapter IV deals with the influence of annealing or heat treatment factors and Chapter V briefly touches on manufacturing processes. Mechanical, physical and chemical properties are discussed in the sixth chapter while the seventh is devoted to finishing malleable cast iron. Chapter VIII is entitled "Defects," and discusses defects common to both white and black heart types, and to black heart malleables. The final chapter is devoted to special malleables or those containing such elements as aluminum, nickel, titanium, copper, cobalt, tungsten, etc. In addition the volume contains a bibliography, and an extremely brief subject index.

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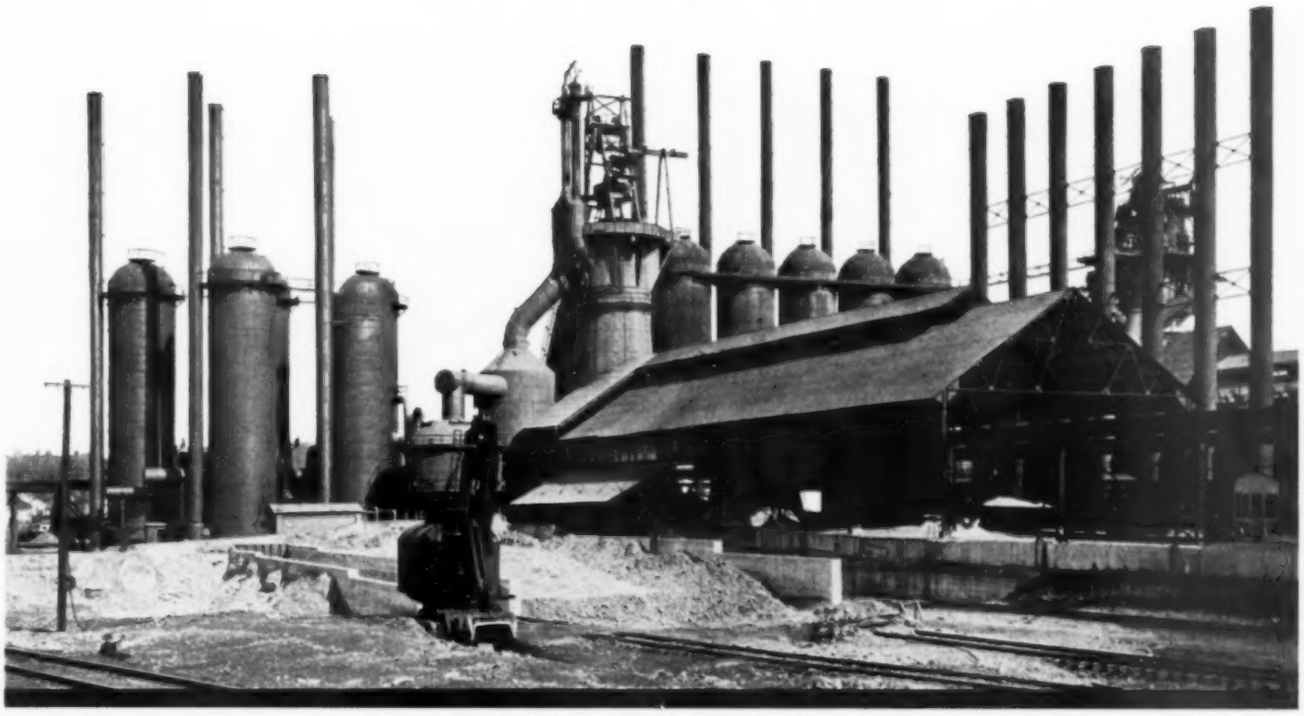

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Gray Iron Receives Attention

Improvement and Use of Alloys in Cast Iron and Effect of Hydrogen on Its Structure Attract Considerable Interest

TWO papers of special interest to foundrymen were presented at the 147th meeting of the American Institute of Mining and Metallurgical Engineers held in New York, Feb. 15-19. One was the annual Howe memorial lecture which was presented by Dr. Paul D. Merica, International Nickel Co. Inc., New York, on "Progress in the Improvement of Cast Iron and the Use of Alloys;" the other a paper on "The Freezing of Cast Iron," by Alfred Boyles, Battelle Memorial institute, Columbus, O.

Other features of interest were sessions arranged by the Iron and Steel and the Institute of Metals divisions, at which such general subjects as ingot solidification, oxides in steel and crystallization were discussed. The sessions on nonferrous metallurgy also attracted the attention of some foundrymen.

More than 2000 members and guests, the largest number in recent years, attended the convention, at which more than 200 papers bearing on various phases of mining and metallurgy were presented. Names of officers elected at the meeting are presented in the table shown on page 56.

Interest in Iron Revived

According to Dr. Merica, the last 15 years have witnessed a revival of interest in cast iron accompanied by remarkable progress both in improvement of its properties and engineering performance as well as in renewed acceptance of it for modern engineering purposes. In 1921, A. S. T. M. specifications for light, medium and heavy gray iron castings called for arbitration bar tensile strengths of over 18,000, 21,000 and 24,000 pounds per square inch, respectively. The society's specifications for 1936 included seven classes of gray iron ranging from 20,000 to 60,000 pounds per square inch tensile strength.

Before the war, best quality gray iron had a tensile strength no higher than perhaps 15,000-20,000 pounds per square inch, excepting small amounts of semisteel which was then under development and which might have exhibited strengths as high as 30,000 pounds per square inch. Today, gray iron is produced in quantity with tensile values from 40,000 to 60,000 pounds per square inch. With special care and attention to foundry technique, tensile values as high as 70,000 to 80,000 pounds are obtained.

Dr. Merica estimated that production of gray iron castings in this country in 1936 totaled about 10,000,000 tons. A conservative estimate is that not less than 10,000 tons of alloys were used in iron castings in the same year, yielding over 1,000,000 tons of alloy iron castings.

Alloys Used Extensively

Of the 3500 iron foundries operating in this country, some 1000 are known to be users of alloys for a portion at least of their castings production. Over 300 of these are substantial users of alloys and the proportion of alloy iron production of many of these is high—from 10 to 35 per cent. Some, particularly those serving the automotive industry, produce principally alloy iron. It is estimated, for example, that over 90 per cent of automotive engine castings are of alloy iron, and the automotive industry probably uses half of the alloy iron made today.

Gray iron responds to heat treatment in a manner quite similar to that of steel, although its tensile strength cannot be increased thereby to anything like the same levels as in the case of steel. In most industries but particularly in the field of transportation and that of machinery and machine tools, modern high-duty irons are finding increasing application. Certain types also are finding wide use because of resistance to corrosion.

In conclusion, Dr. Merica pointed out that gray iron is superior to steel in its capacity to absorb vibrational energy safely. It is well recognized that the damping capacity of gray iron is substantially higher than that of steel and may be double or tenfold that of steels of high elastic limit. This curiously enough is largely in consequence of the effect of those structural features of cast iron which impair its gross ductility and which alter the character of the elasticity.

Mr. Boyles' paper on "The Freezing of Cast Iron" was concerned with an investigation on why cast iron varies in structure producing examples termed the normal graphite flake and fine lacy graphite arranged in a dendritic pattern; the matrix in both being pearlite. Based on limited circumstantial evidence, as the author points out, the experimental work indicated that hydrogen has a decided effect on the form of the graphite in the resulting cast iron.

According to Mr. Boyles cast iron is essentially an alloy of iron, carbon, and silicon whose structure is altered profoundly by the presence of manganese, sulphur, and hydrogen, and that the type of structure called normal is due to the influence of the last three elements. By varying the amounts of manganese, sulphur and hydrogen, a great variety of structures can be produced with the same rate of cooling. To illustrate the effect of hydrogen, the author showed an alloy that froze white due to saturation with hydrogen at 2850 degrees Fahr. as a case of extreme carbide stability.

Note Effect of Remelting

The same metal remelted in hydrogen at 2500 degrees permitted the hydrogen to drop sufficiently for graphitization with formation of fine graphite through slow carbide dissociation. The same alloy remelted in nitrogen at 2500 degrees with still lower hydrogen content favored formation of normal graphite flakes while melting in vacuo at 2500 degrees with the loss of much hydrogen produced fine graphite flakes by rapid carbide dissociation. All melts were cooled at substantialy the same rate.

One point emphasized by the author is that fine graphite may originate at both ends of the range, either by slow or by rapid graphitization. Also in considering the effects of hydrogen, the influence of the other elements in cast iron should be kept in mind. He indicated that recognition of a gas as one of the basic constituents, explains for example, the response of cast iron to various atmospheres. If solubility of the gas is a function of

(*Concluded on page* 56)

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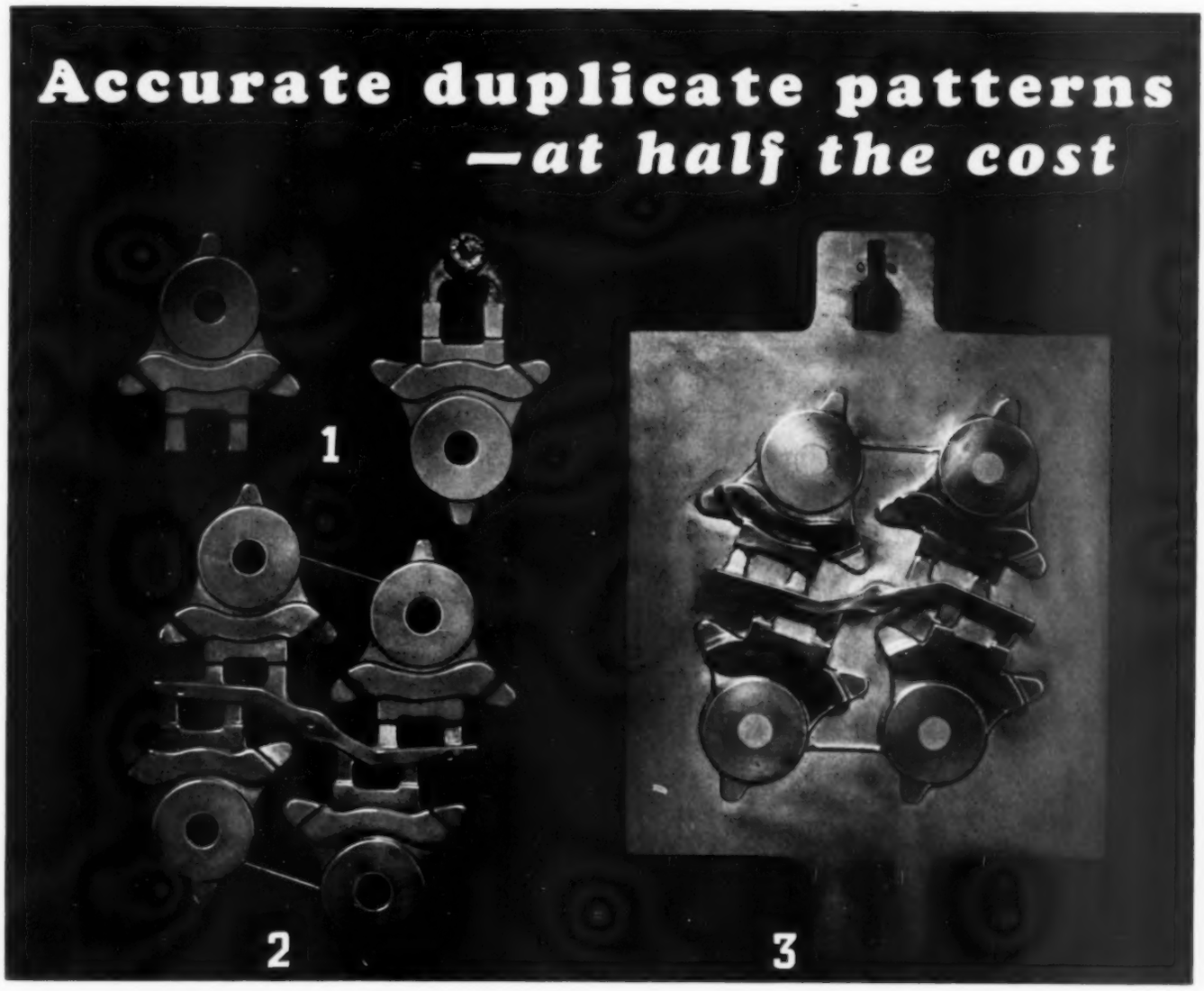

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(*Concluded from page* 54)

temperature, effects of superheating may be interpreted. Further, if some of the hydrogen may be removed from the molten metal by bubbling or mechanical agitation, another class of phenomena may be explained.

For example Norbury's process of blowing carbon dioxide through the molten metal sweeps out some of the hydrogen normally present and produces the same effect as melting under reduced pressure. Blowing hydrogen through the modified metal restores the original condition as stated by Norbury. The author did not attempt to explain how hydrogen causes an increase in carbide stability, but simply offered the hypothesis as a possible explanation of why graphite flakes in cast iron vary so widely. Solution of the problem which is very complex, according to Mr. Boyles, probably will be by synthesis, starting with a base alloy of iron, carbon and silicon to which essential elements are added to reproduce completely the structure and properties of cast iron.

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Ohio Men Emphasize Safety, Hygiene

The Northeastern Ohio Chapter of the American Foundrymen's association featured a discussion on safety and hygiene in the foundry at the Feb. 11 meeting, held at the Cleveland club, Cleveland. In the first talk, E. O. Jones, director of the safety and hygiene section, American Foundrymen's association, covered certain interesting phases of the recent report made by the engineering committee at the national silicosis conference sponsored by the department of labor. Problems arising from this disease, with reference to compensation in varied territories of the United States, also were discussed by the speaker. Mr. Jones pointed out that less than 1 per cent of silicosis cases proved harmful and deprived man of his normal span of life.

J. W. Beal, member of the industrial commission of Ohio, Columbus, presented a stimulating address in which he dealt specifically with industrial problems of health and safety, compensation and insurance in the state. Ohio is the largest exclusive carrier of workmen's compensation, he said. Of the 1400 to 1700 cases submitted to the commission each day, 92 per cent are taken care of within 8 to 10 days. Mr. Beal believes safety should be rooted into the worker's minds 24 hours per day and all rates and compensation should be handled by the companies themselves, to avoid trouble from unethical medical, insurance and legal practices. Education of men in the subject of safety has decreased the steel rate from $2.40 per $100 of payroll to 90 cents per $100, he said. Under the merit system, Mr. Beal stated, the basic rates are not as high. Investigation of all cases applied for should be conducted as thoroughly as possible, including machinery, all equipment, the man himself and the doctor.

B. G. Parker, president, Youngstown Foundry & Machine Co., Youngstown, O., and vice chairman of the chapter, presided.

Book Review

Gmelin's Handbook of Inorganic Chemistry (Gmelin's Handbuch der Anorganischen Chemie), edited by the Deutschen Gefellschaft, paper, 518 pages, 6¾ x 10 inches, published by Verlag Chemie, G.m.b.H., Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, and by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This volume, which is in German, constitutes Part D of the section on iron of one of the best known handbooks of inorganic chemistry. The volume is divided into three main sections describing the magnetic properties of alloy materials, the electrical properties of alloy materials, and a short retrospect on and the future possibilities of the field of the magnetic and electrical properties of alloy materials.

Subheadings under magnetic properties include magnetisability, Barkhausen effect, magneto elastic effect, magneto-mechanical effect, galvanomagnetic and thermo-magnetic effect. Under electrical properties the subheadings include in homogeneous material in contact with solid materials and in contact with gases and vacuums. Various properties are described under the particular alloy system or combination such as iron-silicon, iron-cobalt-vanadium-silicon-carbon, etc. The index is contained in the front of the book which aids considerably in locating the exact reference.

To Hold Conference In Michigan

The program for the fifth annual sectional foundry conference, sponsored by the American Foundrymen's association in co-operation with its Detroit chapter and Michigan State college, has been completed. The meeting will be at Michigan State college, East Lansing, Mich., April 9 and 10.

This annual foundry meeting is designed to appeal primarily to those connected with gray iron production in the automotive casting field. It brings together many leading authorities for discussions on metallurgical and foundry operating problems.

The revised program is as follows:

Friday, April 9

10:00 a.m. Chairman: R. E. Kennedy, technical secretary, American Foundrymen's association, Chicago
"Testing of Materials with Particular Regard to Cast Iron" by R. E. Schneidewind, University of Michigan, Ann Arbor
Discussion: Prof. H. L. Daasch, Iowa State college, Ames, Iowa

2:00 p.m. Chairman: A. J. Herzig, Climax Molybdenum Co., Detroit
"Adaptability of Gray Iron as Engineering Material" by G. P. Phillips, International Harvester Co., Chicago
Discussions: "Wear Testing"
W. E. Jominy, General Motors Corp., Detroit
S. C. Massari, Association of Manufacturers of Chilled Car Wheels, Chicago
P. S. Lane, American hammered piston ring division, Koppers Co., Baltimore

6:30 p.m. Banquet and Entertainment: Chairman: L. G. Korte, chairman, Detroit Chapter, A.F.A.
"Fair and Equitable" by C. C. Carlton, Motor Wheel Corp., Lansing, Mich.

Saturday, April 10

10:00 a.m. Chairman: H. W. Dietert, Harry W. Dietert Co., Detroit
"Artificial Molding Sands" by Dr. R. A. Smith, Michigan Department of Conservation, Lansing
"Core Making" by R. E. Aptekar, American Brake Shoe & Foundry Co., New York

Wellman Bronze & Aluminum Co., Cleveland, has appointed the Ellcon Co., 50 Church street, New York, as exclusive representative for the sale of Ellcon-Wellman products in the eastern district, under the direction of William M. Wampler, president of the Ellcon Co.

ADVERTISING PAGES REMOVED

Discuss Corrosion Testing

Difficulties Involved Make It Hard To Standardize the Methods of Test

TWO symposiums on corrosion and lubrication were included in the program of the regional meeting of the American Society for Testing Materials, held at Chicago, March 2-3. In addition, various A.S.T.M. committees and subcommittees met during the week. Registration was slightly above that of the 1936 gathering, when more than 600 attended.

The symposium on "Corrosion Testing Procedure," comprising six papers, was presided over by F. N. Speller, National Tube Co., Pittsburgh. This session covered the various methods of testing corrosion and was opened by a general discussion of the subject in a paper on "The Principles of Corrosion Testing," prepared by R. B. Mears, Aluminum Co. of America, New Kensington, Pa., and C. W. Borgmann, National Tube Co., Pittsburgh, and presented by the latter.

Tests Are Standardized

This paper emphasized the desirability of standardization of corrosion tests and the difficulties involved. So far only two tests have been adopted as standard by the society. One of the difficulties in standardization has been the lack of correlation between laboratory tests and service life. This partly results from the fact that corrosion resistance is a property dependent upon both the nature of the metal and the character of the environment, and various metals react dissimilarly in different environments.

The following tests were stated by the authors as believed ready for standardization, based on the amount of data now at hand—Laboratory tests: Impingement attack, intercrystalline corrosion, frequency of sites of initial attack, corrosion-fatigue, partial immersion tests and spray tests; Field tests: atmospheric exposure, soil corrosion tests and immersion tests.

Atmospheric corrosion testing is carried out for at least two purposes, it was pointed out in a paper on this subject by H. S. Rawdon, National Bureau of Standards, Washington. The primary purpose is to determine the rate at which the metal is attacked chemically by various agents to guard against an atmospheric corrosion attack. The latter may consist of surface coatings or the chemical treatment of the metal so as to produce a surface condition helpful in shielding the underlying metal.

Atmospheric tests may be made either in the laboratory or in the field. The former usually are spray tests. In field tests it is common practice to choose a number of locations in which the atmospheric conditions differ markedly among themselves. Results of field tests sometimes are misleading if they are not correlated with data as to the environment.

A fundamental requirement for specimens to be used in field tests, if quantitative data are desired, is a large area to weight ratio. This is imperative when the progress of corrosion is to be followed by change-of-weight determinations and it is important even when only visual observations are to be made. This requirement practically limits quantitative tests to sheet material or to thin plates.

Vary According To Purpose

Precision used in making change-of weight determinations must be varied according to the purpose of the test. All changes in weight should be calculated on the basis of unit of area and unit of time. The conversion of change-of-weight data into units of "penetration per year" is not so necessary and helpful in atmospheric corrosion tests as in other forms of corrosion testing.

Change-of-strength determinations preferably should be made on specimens machined from material after it has been corroded rather than on specimens which have corroded after being machined. A change in ductility is a more sensitive indicator of the effect of corrosion than the accompanying change in tensile strength. Tests of this kind are essential for evaluating properly the corrosion behavior of certain types of metallic materials.

Practice of laboratories of Aluminum Co. of America in employing salt spray tests was described in a paper prepared by E. H. Dix Jr. and J. J. Bowman of that company. Illustrations of the boxes and other equipment used in conducting the tests were shown. A solution of 3½ per cent sodium chloride in distilled water was recommended and the use of fresh solution rather than recirculation of the liquid was favored. Spray jets employed are monel metal, though hard rubber also has been found satisfactory. A pressure of 30 pounds has been found desirable, while the temperature should be kept below 35 to 40 degrees Cent. Generally reliable results have been obtained in testing aluminum alloys by this method.

Discussing alternate immersion and water-line tests, D. K. Crampton, Chase Brass & Copper Co., Waterbury, Conn., indicated that the loss of tensile strength is a better measure of corrosion of copper alloys than loss in weight. Damage to a specimen by dezincification, selective solution or by pitting is shown clearly by the percentage of original tensile strength lost during the test. Corrosion by general thinning causes only a small percentage loss in tensile strength, thus bringing the test results more nearly in accord with service behavior. In addition, the specimens need not be cleaned after corrosion, thereby eliminating possibility of error, while difference in density is not reflected in the loss of tensile strength though it may affect the weight.

Control Is Advocated

"Total Immersion Testing" was discussed in a paper by R. J. McKay and F. L. LaQue, International Nickel Co. While the authors did not recommend the adoption of any particular apparatus or test, it was suggested that a procedure be set up which would provide proper control of four vital features such as composition of solution, temperature, aeration and velocity and as many others as may be dictated by the concensus of informed opinion. A review of reports on corrosion testing over a recent ten-year period shows a tendency toward better control and more complete reporting, but much additional attention should

be paid to the four controlling factors listed.

A summary on "Soil Corrosion Testing" was included in a paper on this subject by K. H. Logan, S. P. Ewing and I. A. Denison, national bureau of standards, Washington. Such testing involves: the corrosiveness of the soil; the relation between pit depth and area; and the relation between pit depth and time. Corrosiveness of a soil toward ferrous metals may be determined by measuring the voltage at various current densities of a cell in which the electrodes are steel and the electrolyte is the soil under test.

The precision and range of application of the suggested procedure for soil corrosion tests is limited by imperfect understanding of certain features of soil corrosion, such as the exact nature of the relation connecting pit depth with exposed area. Although this method is not sufficiently well established to be adopted generally, it is believed to constitute a basis on which a standard method might be developed.

The second symposium of the meeting was devoted to motor lubricants.

To Hold Conference In New England

Program for the joint regional conference, to be held April 9 and 10 at Massachusetts Institute of Technology, Cambridge, Mass., has been completed. This two-day meeting, held under the auspices of the New England Foundrymen's association, the American Foundrymen's association and M. I. T., will be devoted to the presentation of discussions dealing with problems of design of castings and certain production casting methods. Nationally known speakers have been secured to lead the sessions. Members of the Boston sections of several national engineering societies have been invited to participate.

Committee personnel for the conference is as follows: R. F. Harrington, Hunt-Spiller Mfg. Co., Boston, chairman; D. L. Parker, General Electric Co., Lynn, Mass., vice chairman; Prof. J. M. Lessells, M. I. T., Cambridge; Walter M. Saunders Sr., Providence, R. I.; Charles F. Miller, Fairmount Foundry, Woonsocket, R. I.; F. W. Oldfield, Builders' Iron Foundry, Providence; P. E. Kyle, M. I. T.; W. J. Maton, Waterbury Farrell Machine Co., Waterbury, Conn.; and D. Tamor, Reading-Pratt & Cady Co., Hartford, Conn.

The program has been arranged as follows:

Friday, April 9

9:00 a. m. Registration
10:00 a. m. Address of Welcome—by Dr. V. Bush, vice-president, Massachusetts Institute of Technology
10:30 a. m. Technical session—Chairman, E. H. Ballard, General Electric Co., West Lynn, Mass.
"Casting Design—Iron" by E. M. Phillips, Turbin Engineering department, General Electric Co., Lynn, Mass.
Discussion
12:30 p. m. Luncheon—Walker Memorial building
2:00 p. m. Technical session—Chairman, Col. G. F. Jenks, Watertown Arsenal, Watertown, Mass.
"Casting Design—Steel" by V. T. Malcolm, metallurgist, Chapman Valve Co., Indian Orchard, Mass.
Discussion
3:30 p. m. Technical session—Chairman, Prof. R. S. Williams, M. I. T.
"Casting Design—Nonferrous" by Harold J. Roast, F. C. S., vice-president, Canadian Bronze Co., Ltd., Montreal, P. Q., Canada
Discussion
5:00 p. m. "Physical Testing of Cast Metals and Laboratory Demonstration" by Prof. J. M. Lessels, Mechanical Engineering department, M. I. T.
7:00 p. m. Dinner meeting — Walker Memorial hall
Presiding: R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston
Speakers: W. M. Saunders, Jr., president, N. E. F. A.
Dr. K. T. Compton, president, M. I. T.
Dan M. Avey, secretary-treasurer, A. F. A.
Lecture: "High Speed Photography," Merwin Horn, Photograph department, M. I. T.

Saturday, April 10

9:00 a. m. Registration
9:30 a. m. Technical session—Chairman, A. S. Wright, Hunt-Spiller Mfg. Co., Boston
"Molding Sand," by W. G. Reichert, Singer Mfg. Co., Elizabethport, N. J.
11:00 a. m. Technical session
"Sand Testing Technique and Demonstration," by Earl E. Woodliff,, research engineer, Harry W. Dietert Co., Detroit.
12:30 p. m. Luncheon—Walker Memorial building
2:00 p. m. Technical session—Chairman, Charles F. Miller, Fairmount Foundry Woonsocket, R. I.
"Cupola Operation," by Donald J. Reese, International Nickel Co., Inc., Bayonne, N. J.
4:00 p. m. Testing demonstration Materials Testing and Photo-Elastic Laboratories
5:30 p. m. Adjournment

Cast Iron Pavement Warns Driver

E. W. Davis, superintendent of the mines experiment station at the University of Minnesota, Minneapolis, has been making experiments with cast iron paving blocks. These were described in an article in the April, 1934, issue of THE FOUNDRY, on page 24. His tests have suggested another idea. In trying out different treads for the cast iron blocks, to give the greatest nonskid results, Mr. Davis has found that various types produce a wide variety of sounds as automobile tires pass over them.

This discovery suggested the possibility of a silent type for the center of the motor lane, with strips producing a higher pitched note placed just inside the curb and along the center line. This would serve as a warning to the motorist when too close to the curb or the wrong side of the road. Under present day driving conditions a few extra precautions might not come amiss.

View of the main educational building groups of the Massachusetts Institute of Technology under floodlights at night as seen from the Charles river

BARTLETT-SNOW *Cutting Feeders* GET RESULTS!...

BARTLETT-SNOW FOUNDRYMAN'S GATE . . . an inexpensive, easy opening, instantly closing gate, designed specially to meet the requirements of foundry service.

BARTLETT-SNOW FLASK FILLER . . . one of a complete line that includes swiveled chute, pivoting boom and single, double and triple, flat and sloped, apron feeder types.

● Bartlett-Snow Cutting Feeders give unequalled service on tempered sand. They discharge the sand uniformly from the bin without emptying first one end, then the other... and at a predetermined rate that is changeable by adjusting a single nut.

The equipment consists of a series of bars pivoted at both ends ... the pivots on one end being fastened to the hopper ... those on the other end, to a crank driven reciprocating arm supported beneath the hopper with stirrups. The tempered sand projects downward, filling the spaces between the bars, and is "cut-off" as the reciprocating support widens and narrows the spaces. The stirrups impart a slight upward and downward motion to the sand ... prevent its arching.

Bartlett-Snow Cutting Feeders, patented, are available in sizes from 9" x 9" to 4' x 15'. They reflect the efficiency of a construction based on Bartlett-Snow's 25 years' foundry experience ... and suggest the obvious advantages of referring your foundry problems to the Bartlett-Snow foundry engineers. What are your problems?

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SAND HANDLING AND SAND CONDITIONING EQUIPMENT
MOLD CONVEYORS AND ACCESSORY FOUNDRY EQUIPMENT

BARTLETT-SNOW RECIPROCATING CONVEYOR . . . requires little headroom. Its pushing, shoving action aerates and cools the sand . . . breaks up the lumps.

BULLETIN No. 75. Complete with 120 illustrations and 26 engineering diagrams, this 44-page booklet describes the Bartlett-Snow method of securing less costly, more efficient operation. Send for one!

ANY OBJECTIONABLE PAGES REMOVED

H'm! 314 miles east of Gloucester!

The Adventures of BILL

By PAT DWYER

EVEN in my somewhat cloistered existence, avoiding as much as possible that type of contact with other people, known I believe in more vulgar circles as poking the impudent old nose into other people's affairs, I have noticed that the obsession of infallibility, the I'm-positive-I'm-right complex is a rather common disease.

I regret that I have no tables or charts by me at the moment to prove this assertion. Speaking offhand, and of course off the record, and furthermore depending on a more or less slippery memory that is none too reliable at the best of times, I should say—or rather cautiously venture the opinion—that this particular blind spot is found as frequently among the mental half pints and nitwits as it is among the two-gallon jug and full barrel intellects.

In other words, if one may be pardoned for coining a special phrase for the occasion, supreme egotism is found where you find it.

Perhaps, as in my own case, a recent offering on the silver screen, brought back memories to many people of Kipling's only American and highly delightful story *Captains Courageous*. To my mind the only story to be bracketed with Stevenson's immortal *Treasure Island*. They will remember how Disko Troop, able master of the Gloucester high liner WE'RE HERE held firmly to the conviction that he never were mistook in his jedgement.

Contrary to the totally unwarranted foundation set up by the majority of these This-rock-shall-fly-from-its-firm-base-as-soon-as-I people, the resourceful and highly competent Captain Troop had good and sufficient anchorage for his belief. For 25 years, drenched to the skin most of the time, he had wrestled the north Atlantic ocean, his only navigating instruments a delicately sensitive nose and a lead line, one cocked knowingly to windward and the other heaved in a long arc forward of the plunging bowsprit.

He sniffed the air and he looked at, smelled and sometimes tasted that portion of the ocean bottom adhering to the tallow in the lead line. From the combination he drew conclusions which set the WE'RE HERE on a course as definite as that of any furry legged bee heading for the hive or the hole in the old hollow tree, or any sleek homing pigeon winging its way from foreign territory to the familiar dove cot on top of the livery stable. Rain, snow or hail, fog, the curse of the banks, or a screeching gale that threatened to whip the sticks out of the WE'RE HERE by the roots did not affect the jedgement of this doughty mariner. He knew exactly where he was going and without more ado and in spite of everything he went there, pronto.

From long experience his crew also believed in his possession of an extraordinary or sixth sense which enabled him to locate schools of fish, even when other masters declared to high heaven that the ocean apparently was fished out. This tarry old sea dog, pickled in brine and no doubt smelling horribly, knew where they were. Not only in the immediate vicinity below the schooner and concealed from the vision of ordinary men by a paltry 20 to 40 fathoms. Not at all. None of that amateur stuff for Disko.

He pays the fish a personal visit

Having caught all the fish willing or unwilling to be caught in any given locality, before they fled in terror on a grand hegira, he closed his eyes, took a few good satisfying sniffs and decided that on the following day he would meet his little finny friends again at a point somewhere within a 100-mile circle.

He had this point as definitely in mind as the ordinary city dweller who proposes to meet a friend, or any other person, in a building on the northwest corner of 46th street and Juniper ave. Whereas the city man has to do a bit of zig-zaging to reach his destination, Disko with a fair wind and every stitch drawing, flew to the spot as straight as the crow flies, if one can place any reliance in the old saying, and if any person can imagine one of those wily birds silly enough to fly over the open sea.

If he had a head wind he reached his objective, still with every stitch drawing, including jib and jumbo, in a minimum number of long reaches to port and starboard. When he threw out his lines the following day, the school of fish that had fled in terror the day before, recognized the shadow of the schooner and murmured among themselves: Might as well give up, boys. Here's that tarry old devil, just like a G-man right on our tails!

If pressed into a corner I shall

(*Continued on page* 66)

"Among those present!"

Will YOU be there . . . among those present at the foundry convention which opens in Milwaukee, May 3?

On this significant occasion, foundrymen all over the world may be effectively reached by your sales message in the April *Pre-Convention* issue of *The Foundry*.

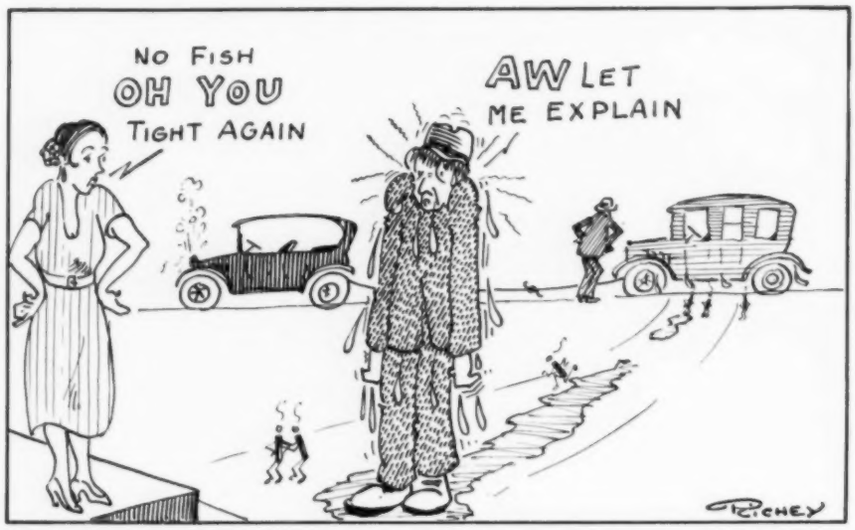
You may be assured of effective representation—you may contact foundrymen who go to Milwaukee, and those who remain "on the job" by reserving advertising space in this issue. Forms close April 1st.

THE FOUNDRY

45TH YEAR

(*Continued from page* 62)
have to admit that one of the many interesting twists in this elegant yarn leads up to a denouement in which the infallible captain has to admit that in at least one instance "He were mistook in his jedgement." However, that is neither here nor there except that with such a copper fastened, *A* No. 1 at Lloyd's example for a guide I need not feel any compunction at changing my mind occasionally.

Some time around Christmas, Bill persuaded me one night to visit the home of one of his friends. I forget the exact date, but that is not a factor of any importance in the following veracious chronicle. If I were to spend half an hour telephoning and checking up on this item and then set it down here 'twould probably go in through one of your eyes and out through the other like water off a duck's back. Anyway, as man to man, what difference does it make? As Harry Lauder remarked in that charmingly tipsy monolog describing his meeting with Sir-r-r Er-r-rnest Shackleton—later to be addressed familiarly and intimately as "Shack" — in a pub " 'Twas near-r-r the end o' the week, anyway!"



Tense situation in: When Johnny Comes Marchin' 'Ome Again. 'Urrah! 'Urray!

Some time around Christmas and near the end of the week—surely that is definite enough for any person not connected with a government bureau—Bill and I set out to see what he enthusiastically described as a really remarkable exhibition of hunting and fishing pictures.

"This lad," Bill said, "is the president and mechanical genius of a stove company. He has two main hobbies. One is perhaps the most completely equipped home work shop in the city, and the other is hunting and fishing. Fortunately he now is in position where he no longer has to worry about the butcher, the baker and the candlestick maker. When he feels the urge to go out and shoot something, or to ketch a mess of fish, why, he just goes. He closes his desk, puts on his hat, telephones his wife that he is off for a month or two in the wilderness and that she can expect to see him again when she sees him. He usually selects some god-forsaken section of the earth's surface, where as the feller says the hand of man never yet has planted his foot. Some place where Jim Farley has no post office and where even the most optimistic business promoters of the telephone and telegraph companies have no record on their remote prospect sheets.

"Before leaving, he drops in for a brief interview with Joseph Stoneface Fish, president of the First National Bank. 'Joe,' he says, 'I'm off for a little jaunt away out back of beyond. Pack me up a duffle bag or a nail keg or something with a few bundles of the old mazuma, the kale, the long green, enough to last me for a month or two in company with a camp crew, a few guides and a string of pack horses. Well, so long, Joe, I'll be seein' ya.' "

A very fine motion picture camera was included in the equipment which accompanied him in the latest expedition into the wild and desolate mountains of northern British Columbia. The pictures reproduced in natural colors were among the most remarkable and interesting I have ever seen.

However, for some reason, I failed to become enthusiastic over the scenes showing the actual shooting of grizzly bears and mountain sheep. An extra reel at the end, thrown in for good measure and showing a lad catching fish, unhooking them and throwing them back into the lake struck me as an unnecessarily cruel form of sport. I made a mental vow to never go fishing again. I have kept that vow for the past couple of months and probably would have kept it indefinitely if Bill had not called around last night with insidious propaganda on a proposed fishing trip. His account of a rather trivial adventure he had last summer tipped the scale in his favor and made me realize that perhaps after all I were mistook in my jedgement.

"I don't think," he said, "I ever told you of sundry and divers—and believe me kid, divers is right—sundry and divers happenings on a small solo trip I made one day last summer. You know that gap where the breakwater extending at right angles from the shore comes within 40 or 50 feet of the main wall. At one time the gap was filled with water to a depth of 10 feet, but it gradually filled with sand until now the water is only a few inches deep except during a high wind from the east.

"This day I drove the old car across the gap and parked it on the sand. Then I tramped for about half a mile along the wall looking for minnows for bait. The water was as clear as crystal and at one particular point I saw a big bass coyly retreating under a rock. I had seen this same lad on former occasions, but never had been able to do anything with him. Through a sixth sense which all true fishermen possess I knew this was my lucky day and if I only had the bait he was as good as in the bag. I walked back almost the full length of the wall and finally spotted a small school of minnows. They were almost beyond reach but by leaning over at a highly perilous angle I dropped the small hand net among them.

"The final effort loosened a package of cigarets in my shirt pocket and it fell into the water. A brand new pack, mind you, never touched. Well, you know yourself that a man might just as well try to fish without bait as without cigarets. I made a wild grab for the pack—and fell in, body and bones. By the time I came up and secured a grip on the wall, the cigarets were beyond reach, the minnows probably were half way across the lake speeding under forced draft, and I realized that the fishing was over for *that* day.

"I had to strip off the clothes and wring 'em out and when I climbed into the car I found that a shift in the wind had placed a lake of water more than a foot deep between me and the shore. The continued run of ill luck had somewhat soured my

(*Concluded on page* 68)

PROFITS and the HERMAN

"If It's a Herman It's Worth Using; It Made Its Way by the Way it's Made."

In more than one instance the Herman Molding Machine has been the deciding factor in a foundry's molding department showing a profit.

With the ability to increase production from two to five times over old methods the Herman is building for itself a record that promises to be the most outstanding in the industry. Hermans are making railroad car wheel molds at the rate of one a minute with one cope and one drag machine; as many as two hundred and ten car side frame molds have been made in nine hours on a pair of Hermans; while one hundred and forty bath tub molds are made in eight hours on a pair of Hermans.

Everywhere reports show that Herman installations increase production, cut costs and produce more nearly perfect molds. Learn how the Herman can help you increase profits. Whether your work is large or small the Herman can do it better. Write for details.

HERMAN PNEUMATIC MACHINE CO.
PITTSBURGH, PA.

(*Concluded from page 66*)
usual sunny disposition and instead of trying to sneak across cautiously, I opened her up and the resulting splashes killed her and left me there stranded. The water was too deep for me to get out and try to push. After a couple of hours of acute mental and physical anguish a fella came by in a car and pulled me on to dry land.

"Just to show you how a trifling little mishap will throw all the mental apparatus out of gear, I felt sure that if I wiped and dried the spark plugs the old boat would sail away. Well, it didn't. I overlooked the distributor points. The good samaritan had to tow me all the way home. The Missus was waiting on the door step as the sorry caravan turned into the yard. Seeing me with head bowed and apparently helpless she jumped to the totally unwarranted conclusion that some wicked men had induced me to partake of the demon rum and maybe that did not give her a text for a sermon! 'You are away all day,' she says, 'and then you come home drunk without a fish and with the car a wreck. God help all poor fishermen's wives.' she says."

I think I shall go with Bill next time. Perhaps he'll fall in again.

Alloys Considered In Eastern Meeting

S. W. Chappell, Electric Boat Co., Groton, Conn., spoke on "G Metal and Manganese Bronze," at a well-attended meeting of the Connecticut Nonferrous Foundrymen's association held Jan. 19 at Hotel Duncan, New Haven, Conn. Ernest Stone, Consolidated Ashcroft Hancock Co., Bridgeport, Conn., discussed in an interesting manner the subject of "Nickel Alloys."

An entertainment committee was appointed for 1937 with Roy Hunter, 141 Milk street, Boston, as chairman. He will be assisted by George Hubbell, Mullite Refractories Co., Shelton, Conn., George King, Malleable Iron Fittings Co., Branford, Conn., Byron Ried, Reading Pratt & Cady Co., Hartford, Conn., and Louis G. Tarantino, 565 West Taft avenue, Bridgeport.

The program committee for this year also was appointed. Frank B. Diana, Whipple & Choate Co., Bridgeport, is chairman, assisted by L. A. Ward, Chase Brass & Copper Co., Waterbury, Conn., and Mr. Tarantino.

V. P. Weaver, American Brass Co., Waterbury, spoke on "Sand Cast Silicon Alloys" at the Feb. 16 meeting of the association. He outlined developments in the chemical and physical properties of these alloys. T. Joseph Judge, president of the association, presided at both meetings.

Discuss Apprentice Training

Victor J. Hydar, manager of personnel, Falk Corp., Milwaukee, discussed apprentice training at the Feb. 9 meeting of the Northern Illinois Foundrymen's association, held at Schrom's cafe, Rockford, Ill. Mr. Hydar defined apprenticeship as training on the job. He believes that a program should be inaugurated by various trade associations because of the current scarcity of apprentices in the foundry industry.

Such a program, he stated not only would be of benefit from a business standpoint but also would be a social service to the boys. Mr. Hydar made a comparison between plants organized to train apprentices and those whose boys worked without direction. He said that in general schools do not recognize the fact that the majority of students enter industry. In many cases they are directed into literary courses only to apply later for jobs which will train them to be machinists, welders, etc. The speaker concluded his interesting talk by giving a short history of apprentice training at the Falk Corp. where 135 boys normally are enrolled. Mr. Hydar emphasized the fact that apprentice training is not expensive and upon completion of the course, the boy makes a better citizen.

C. A. Nass, vice president of the association, presided.

Minnesota May Use Iron Pavement

Cast iron pavement may be given a trial in Minnesota. If the test can be made without additional cost to taxpayers, the new pavement will be placed on a heavily traveled highway in ore-producing St. Louis county. The project involves 4369 square yards of paving surface and would entail additional expense of approximately $7000.

St. Louis county, which requested a change in specifications to permit the use of this type of paving, has appropriated $15,000 to make the trial. If the manufacturers of the pavement will share the expense, a request to change the specifications will be made to the United States bureau of public roads. N. W. Elsberg is state highway commissioner.

Book Review

Spectrum Analysis with the Carbon Arc Cathode Layer, by Lester W. Strock, cloth, 56 pages, 6 x 9¾ inches, published by Adam Hilger Ltd., London, England, and supplied by THE FOUNDRY, Cleveland, and in London by the Penton Publishing Co. Ltd., Caxton House, Westminster.

This book describes the special methods of spectrum analysis applied to minerals by Prof. V. M. Goldschmidt and his co-workers at Goettingen. The book is divided into five chapters of which the first discusses the general principles of the cathode layer method. The second describes spectrum analyses with the cathode layer method by visual estimation of absolute intensities and matching with a standard spectra. Chapter III is entitled "Refinement of the Cathode Layer Method by Photometric Measurements" and Chapter IV is entitled "Acknowledgements." Chapter V is an appendix which discusses the elements determined, and various references, the outline of the various procedures used in applying the cathode layer method, and a list of elements determined in Goettingen, lines, methods, etc., used.

Milwaukee Chapter Studies Melting

The regular meeting of the Milwaukee Chapter of the American Foundrymen's association was held Feb. 19 at the Schroeder hotel, Milwaukee. With 145 men attending the meeting, interesting talks were given by George Long, Pickands Mather Co., Don J. Reese, International Nickel Co., and S. Swain, North American Refractories Co.

Mr. Long discussed cupola practice, giving practical illustrations of the proper charges to use for producing definite results. Mr. Reese presented data on melting furnaces and considered various costs of melting in different types of equipment. Mr. Swain referred to the causes of refractory failures and suggested that a proper foundry analysis of such failures would lead to their elimination and considerable saving in costs.

William F. Bornfleth, chapter president, presided.

Publish Radiography X-Ray Papers

The American Society for Testing Materials, Philadelphia, has published 12 extensive technical papers and their discussion, comprising the symposium on radiography and x-ray diffraction methods held at the thirty-ninth annual meeting of the society June 30-July 1, 1936, at Atlantic City, N. J. Six papers deal with the principles, applications and relations of radiography. Six are devoted to diffraction equipment, methods, applications to nonmetallic materials, etc. Copies in cloth binding may be obtained from A.S.T.M. headquarters at 260 South Broad street, Philadelphia, for $4.00.

Fig. 1—Student operator making molds

Training Makes Students Self Reliant

By ROBERT ALLEN
Student, Crane Technical High School, Chicago

Foreword

By R. W. SCHROEDER
Foundry Instructor

THE report following was written by one of the student reporters on the staff of the *Crane Tech Chronicle*, published by the Crane Technical High School, Chicago, and gives a good example of the training given in technical schools. A closer contact with industrial plants and manufacturers should prove beneficial to all concerned. As a means of advertising, the makers of foundry equipment would search far before finding a field so rich. It is from this group that the future skilled workers and leaders of industry will be developed. The impressions made now when the mind is in the formative stage will be lasting ones.

Not many school shops are equipped to give a student the proper conception of an industrial plant. Apprentice training is beyond the scope of regular school curriculum but with better equipment, more time and closer co-operation, schools would turn into industry valuable products. Is it asking too much of industry to take an active interest in technical high schools?

The cry for skilled mechanics is being heeded, but the possibilities of foundries co-operating with schools in supplying training goes unheeded. Industry may not know that beginning Feb. 1 the technical high schools of Chicago, Crane, Lane and Tilden, are to offer a new type of course, which will help solve this problem and give to that large group of students who do not and cannot go on to college, a training which will fit them better for industry.

The plan provides that the first two years of the high school course will be the same as in the past, but a student entering on the third year will be given an option of continuing with a course fitting him for college entrance, or he can elect to pursue an industrial training course during the last two years. Selecting this latter course, he will elect the trade he prefers and then will receive four hours a day in shop instruction and practice, and two hours a day instruction in related class work.

For example, if the student chooses foundry work, he will spend four hours a day in the foundry shop, molding, making cores and melting metal, and two hours a day in the class room on chemistry, drawing, English and mathematics. Managers of foundries are asked to co-operate in making the school's foundry work effective and provide jobs for students when they complete their work.

Competence Is Revealed

BECAUSE students receive a generalized training in high schools and even in technical high schools, various industries in the past have looked upon the problem of vocational training as that of an elementary nature. That misconception is predominant especially in the foundry industry where men with practical foundry experience are preferred to school trained employes.

It is admitted that a high school graduate is not at all equipped to enter an industrial plant and begin work. However, the training given to students in foundry practice in modern high schools is far from the elementary type that industrialists believe.

Every important phase of the foundry is taught under the strict supervision of competent advisors who have had years of experience in the foundry and a thorough knowledge of their subject.

In addition to the theory, which is important to the worker in every conceivable phase of the foundry, the practical application of the theories is taught. That is what is of primary importance to manufacturers, namely, education applied to manufacturing problems.

An unbelievable amount of practical knowledge and training is given the high school foundry students. The core room, molding floor, melting department, pattern making and numerous other phases of the work are studied by the student with an eye not only to gen-

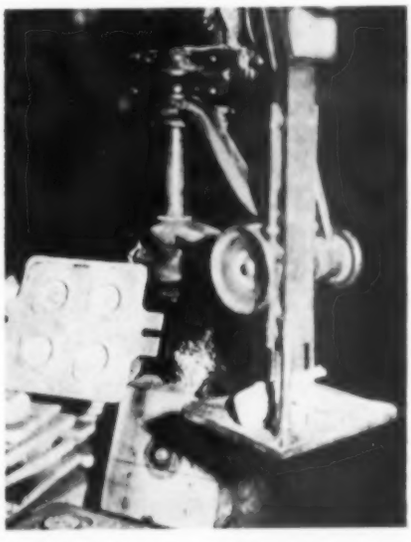


Fig. 2—Squeezer mounted on support pillar, and matchplate

eral knowledge obtained but also with a view to practical work required in large industrial foundries.

To illustrate the co-ordination and production methods used in an average technical high school, equal to any similar problem that would present itself in any manufacturing plant, the following example is cited. The incident occurred at the Crane Technical high school, 2245 West Jackson boulevard, Chicago, in December, 1935, during the convention at the Stevens hotel of the American Vocational association.

An order came into the foundry of the school to manufacture 2400 ash trays for a banquet of the A.V.A. The order explained that an ash tray was to be placed at the plate of each person attending the banquet as souvenirs of the occasion. The order came rather late to be certain of its completion in the short period of time prior to the proposed banquet. Because of this fact it became necessary for the foundrymen to resort to swift measures to allay the fear that they would not be produced in time.

Floor Space Limited

Work was begun immediately under the supervision of the three foundry instructors at Crane—Roy W. Schroeder, George A. Davis and Paul A. Becker. Unfortunately the floor space for such a production schedule as had to be carried out, was limited. Therefore, an ingenious method was devised to handle a hand squeezer machine. The head and base of this machine were strapped to one of the supporting pillars in the foundry shop. This simple procedure entirely eliminated the large amount of floor space usually taken up by the machine.

A match plate was constructed in the shop so that four castings were produced in each individual mold and a good deal of time was saved by having a gate on the pattern plate so constructed that it eliminated the cutting of the gates with a hack saw. These gates were designed so that the castings could be broken off in a manner similar to that employed in gray iron foundries.

The metal used in the castings of the ash trays was aluminum alloy No. 12. It was poured at approximately 1300 degrees Fahr. and the temperature was controlled by the use of a thermocouple made by the Illinois Testing Laboratories. The sand was conditioned by the use of a Simpson sand muller and a Combs gyratory riddle. After pouring, the small gate was ground off and the castings scratch brushed. A small amount of filing was found necessary on the parting line.

Each mold required from 3 to 3½ minutes to produce. A rigid inspection was necessitated by the lettering and the design on the castings. A special order of 50 bronze trays for the speaker's table required special care. The edges of these had to all be polished and buffed. These castings had a Flemish finish while the scratch brushing on the aluminum trays resulted in a satin finish.

The operation of the molding machine, the melting of the metal, the grinding and the scratch brushing of the castings were all done by the students. The instructors acted only as supervisors during the work. However, the amazing thing about the whole procedure was that the majority of the students only possessed training equivalent to three working days of eight hours each.

Fig. 3—Putting the finishing touches on the castings

This actual example definitely shows the extent of training a technical high school gives to its students. A better example would be difficult to find. At the present time the Crane Technical high school foundry is working on a schedule of 2000 aluminum castings a semester. These castings are motor end bells for use in the electric shops. The metal for these castings, which are a little bit harder to manufacture, is kept around 1250 degrees Fahr. to avoid shrinkage in the hub.

Foundry work at Crane is divided into three major groups, lecture, bench and floor work. Due to the large classes a new method is used to take care of the students. Each week the classes rotate between the foundry and the lecture room. One week there are 21 students in the foundry on the bench and 21 on the floor with 42 in the lecture room. The next week the shop class and the lecture class groups are rotated. At the middle of the semester the floor and bench groups rotate.

The shop operates like a regular industrial foundry with a foreman, a safety assistant, mechanical assistant, melting assistant, bench and floor foremen and roustabouts.

Testing the sand before each boy is allowed to start molding, checking of the castings poured, and answering questions pertaining to the work are a few of the duties of the shop foreman. This position helps to develop or discover any traits of leadership or executive ability a boy might have and is a valuable part of his training.

The safety assistant attends to the cleanliness of the shop and enforces all the safety measures, besides suggesting new ones which might increase the precautions against accidents.

The melting assistant has charge of all melting, pouring and the care of crucibles and furnaces. The mechanical assistant is responsible for all equipment in the shop and the roustabout dumps all molds, cuts off gates, returns scrap metals and does all the things that makes the shop neat, clean and a safe place to work.

Accuracy Is Stressed

Additional foundry work consists of lectures on the structure of metals and sand, modern foundry layouts, buildings and equipment. The purpose of this is to acquaint the students with the industrial plant from the management as well as the workers view point.

Habits of work, promptness, and dependability are impressed upon the foundry student throughout the Crane course, as well as the stressing of the point that quality rather than quantity is the students' goal. Speed then is built up through accuracy. This method, it has been found, does not discourage speed but quite the contrary.

Probably the most important point in the training of the Crane student for the industrial world is the co-ordination of mind and hand. This principle must be mastered by every technical student if he is ever to accomplish anything in industry. Exactness is also a requirement that is stressed in every phase of the work.

The most important work of the entire course can be summed up by stating that it is to train boys to think and to think orderly and if it has accomplished this, the school can relinquish its hold on the student, knowing it has sent into the industrial world a product worth while.

Where a real safety program is followed, efficiency and economy of the highest order also will prevail.

Test your knowledge of FOUNDRY FACTS

Here's an opportunity for you to review what you know about the foundry business, and perhaps learn something new. Every month the Milwaukee Foundry Equipment Company issues a folder with a question pertaining to some important phase of the foundry industry. The foundryman receiving the folder is asked to jot down his answer, then compare it with the correct answer given in the "safe".

We cordially invite you to join us in playing this FOUNDRY QUESTION AND ANSWER GAME. You'll find it both interesting and instructive. Watch for your copy of the monthly folders.

This little "Safe" contains the answer to vital foundry questions. It forms a part of our monthly folder sent to all who are interested.

No. 123 Stationary Unit—Same as the No. 124 with 12" squeezing piston, but without wheels and mold shelf.

Milwaukee Jolt Squeezers

Produces good molds, quickly and easily. Built for high speed operation. All parts arranged to operate with minimum effort. Readily accessible from three sides.

No. 124 Portable Unit—A brand new machine with 12" squeezing piston. Easily and quickly portable.

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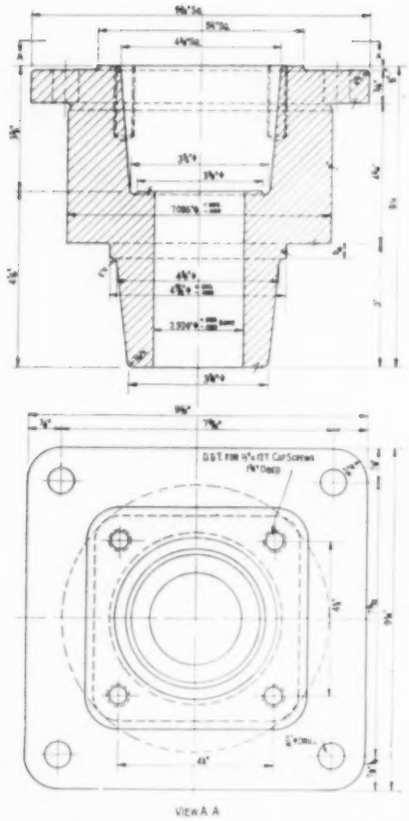
Iron Mold For Lead Casting



Plan and section of lead casting to be poured in iron mold

DESIRE to speed production suggested the use of a metal mold for the hard lead bearing casting shown in the accompanying illustration. According to a tentative plan the lead casting will be poured square flange up in a split mold with the plunger for forming the center opening, working through a hole in the top of the mold. Factors to be considered include the approximate thickness of the metal in the mold walls; advantages or disadvantages in water cooling the mold, and possibly the character of a good material for coating the mold to prevent the lead casting from sticking.

Apparently there is no real reason why the metal mold for the purpose outlined, should not work satisfactorily. The only really important feature is whether the number of lead castings on order will justify the cost of the metal mold in comparison to the cost of making the castings in sand in the ordinary manner. Offhand and without any detailed study one might be inclined to the opinion that a man with a small jolt machine would turn out more castings in a given time than a man working the iron mold. However, there may be other factors in the problem which tend to influence the final decision of the foundryman in selecting a metal mold in which to make the lead castings.

On account of the comparatively low melting temperature of lead—between 600 and 700 degrees Fahr.—the problem of preparing a suitable iron mold is not so complex as with a mold for iron, brass or bronze. Even with the problem simplified to a considerable extent, it may be pertinent to suggest that a recognized manufacturer of permanent molds can supply a better product and probably at less cost than one made locally.

At one time or another water cooled molds have been tried for various types of castings, but almost invariably the water has been a source of trouble. Modern permanent molds are air cooled by greatly increased radiation surface presented by thin vanes or other projecting members on the outside of the mold. For the same reason the wall of the mold is comparatively thin, in the present instance from 1 to 1½-inch.

Mold Split in Two

The simplest type of permanent mold is split in two parts diagonally across the center, hinged at one side, provided with a suitable clamping device on the opposite side. Metal is poured into the mold through a single pop gate on top, at one side of the central plunger and appears in a single riser on the opposite side. Both gate and riser are on the diagonal parting line so that the mold may be stripped from the casting.

The hole in the center of the casting may be formed by a sand core as in ordinary practice, or it may be formed by a metal plunger. If the plunger is all in one piece, the round section in the lower part of the mold probably will *draw* the surrounding metal with it during extraction. It may be necessary to form this plunger in two parts, one telescoped inside the other. In that manner the long, circular part of the plunger could be pulled upward while the soft lead shoulder at the point marked *L* would be held firmly by the upper or second part of the plunger. An alternative method would be to pull half the plunger through the top of the mold, and the other half through the bottom.

A slightly different type of mold is made up of a 1-piece bottom plate, 2-part cover plate and 2-part split, hinged body. Naturally this mold involves a great deal more machine and finish expense. Molten lead should be poured into these molds at as low a temperature as possible and therefore no coating is required to prevent the casting from sticking to the mold.

Book Review

Eisen-und Stahllegierungen, by A. Gruetzner, paper, 426 pages, 7 x 10¼ inches, published by Verlag Chemie, G.M.B.H., Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, and in Europe by the Penton Publishing Co. Ltd., London.

This volume which is a supplement to *Gmelins Handbuch der Anorganischen Chemie*, various sections of which have been reviewed from time to time, adds considerably to the scope of the series devoted to the metallurgy of iron and steel. While a previous section was devoted to the numerous patents on iron and steel alloys, that only extended to the early months of the year 1932. This volume on the same phase covers the patent situation to the end of 1934. As in the previous section the various alloys are tabulated alphabetically under chemical symbols beginning with carbon-aluminum (C-Al) which is followed by carbon-arsenic (C-As), carbon-aluminum-arsenic (C-Al-As), etc., and ending with an extremely complicated alloy, carbon-cobalt-copper-molybdenum-nickel-silicon-tantalum-titanium-vanadium-tungsten-zirconium (C-Co-Cu-Mo-Ni-Si-Ta-Ti-V-W-Zr). In each case the percentage of the various elements designated in the listing are given followed by the properties or proposed applications of the alloys, and then by the authority and literature references. Patent references relate to German, English, French, Austrian, Swiss, and United States patent offices.

Dunbar Engineering Co., 103 Park avenue, New York, has been appointed representative of the Geo. P. Reintjes Co., Kansas City, Mo., for its sectionally supported walls and arches.

MISSING PAGES REMOVED

Basin Is Set Above The Mold

(*Concluded from page* 35)

with blacking after the dried sections are placed on each other. When the dried mold has been assembled to the desired height, the long core is lifted by the crane, suspended vertically and lowered into the mold. The final section of the mold then is set in place and the mold is made ready for the molten metal.

The dry sand core is made and dried in halves. Each half is reinforced with heavy rods designed to support the entire weight of the core on the comparatively slender neck on the lower end. A vent passage on the adjoining flat faces of the two half cores extends from end to end. The two halves are joined with a ribbon of paste and with strands of wire around the necks and at several points on the body. In the mold, the core is held in place by the bottom and top prints and by a few stud chaplets near the center. The chaplets prevent the core from springing or sagging when subjected to the heat of the metal. Any variation in the position of the core would affect the thickness of metal in the adjoining part of the mold with a consequent rejection of the casting. Each finished casting must balance truly on the center shafts. To attain this delicate balance the larger shells are machined on the inside.

Loam Molds Used

The long narrow neck of the small core is held down on the top by a steel bar which rests on the edge of the circular runner basin and is clamped to the flange of the flask. After the casting has solidified the bar is released to permit the core to expand.

Large shells are made in loam molds as shown in the accompanying illustration. The core is built on a foundation plate, while the outside part of the mold is built inside a number of cast iron flask rings. Foundation ring and flask rings are machined and with that arrangement the core may be built around one spindle, while the outside is built around a second spindle set up some distance away. By varying the thickness of loam wall, shells of various diameters may be made in succession in the same set of flasks.

In setting up the molds for casting, only a comparatively shallow pit is required, and that merely to minimize the height to which the ladle has to be lifted. The usual drudgery of placing a loam mold in a deep pit and then ramming the space between the mold and the wall of the pit is avoided and that is a worthwhile consideration as anyone can realize easily.

Great care is required in the original setting of the spindles so that they are truly vertical and perpendicular to the foundation plates. Any slight variation in this respect would result in a nonconcentric mold and core. As stated previously, absolute concentricity is the most important feature of these castings. Exceptionally high ovens are provided for drying the molds and cores. Here also, tracks and cars must be maintained straight and level to prevent the high cores from assuming any but a truly vertical position.

In closing the dried mold, the core first is lowered into the pit where it rests upon a level foundation. The outside part of the mold then is lowered into place. A sloping joint *C* around the bottom of the inside of the mold, coincides with a corresponding joint on the bottom of the core. Since the joint is a true circle, no adjustment is required circumferentially.

After the mold is closed, a number of blocks or bricks *B* are placed on the top to support the runner basin, thus leaving a clear space between the bottom of the runner basin and the top of the mold. The runner basin is bricked on the inside, daubed with loam, blacked and dried. By pouring the metal rapidly the basin is kept filled until the operator can see the metal rising in the sinkhead on the casting. He then ceases pouring and the metal in the basin drains through the gate openings to fill the remainder of the space in the top of the mold. With occasional minor repair the runner basin may be used repeatedly.

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of The Foundry or of Its Editors.*

Heat Stopper

TO THE EDITORS:

I am replying to your article in the February issue of THE FOUNDRY on page 38 entitled "Pour High Chromium Iron Over Lip". There is a big advantage in pouring high chromium iron with a bottom pour ladle. It produces a better and cleaner casting. There is absolutely nothing wrong with the stopper or nozzle in this case. The trouble seems to be with the parties using the ladle. The reason the stopper sticks to the nozzle is because the stopper and nozzle are too cold. Consequently, on the first opening, if not enough metal passes through the nozzle to heat the stopper and nozzle to approximately the same temperature as the metal, they stick.

In closing the nozzle it is bound to stick as the cold stopper and nozzle chill the metal around it when closed and weld the stopper to the nozzle. The remedy is in getting the stopper and nozzle as hot as the metal, or approximately so, and that will be assurance that there will be no trouble.

Be sure to let enough metal flow through the nozzle on the first opening and not leave the nozzle closed for very long on the first three or four openings. Open the nozzle as fast as possible until the stopper and nozzle are heated. After that, no more difficulty will be encountered. But be sure to get the ladle and stopper good and hot before tapping metal into it.

FRANK M. MEYERS

7938 *Essex Ave.,*
Chicago.

Amorphous?

TO THE EDITORS:

What is amorphous graphite? I don't mean who sells it, but what do the words mean?

Graphite is carbon in a certain well defined crystalline form. Amorphous substances are those without crystalline form. Evidently amorphous graphite is a crystalline form of carbon which is not crystalline. This seems to be the reductio ad absurdum.

It is indeed possible to prepare amorphous carbon; the condition is approached in the kinds of carbon that were used in gas masks and in some other cases where adsorption is desired. Carbon can not however, be both graphite and amorphous at the same time and I regret seeing THE FOUNDRY lend one of its headings to a senseless trade name.

H. A. SCHWARTZ,
Manager of Research
National Malleable & Steel Castings Co., Cleveland.

Show Approaches Record

(*Concluded from page* 34)

An excellent array of papers have been prepared for presentation at the various technical sessions, and there is little doubt that spirited discussion of them will take place. The papers relate to all the numerous phases of the foundry industry, and consequently, there is something of interest to every individual associated with the industry. At present the agenda includes the following papers:

"Ferrite, Its Occurrence and Control in Gray Cast Iron," by Richard Bancroft, Perfect Circle Co., New Castle, Ind., and A. H. Dierker, Ohio State University, Columbus, O.

"Effect of Coke Size on Cupola Melting," by J. A. Bowers and J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.

"Pressure Castings," by H. H. Judson, Goulds Pumps Inc., Seneca Falls, N. Y.

"Graphitization and Inclusions," by John W. Bolton, Lunkenheimer Co., Cincinnati, O.

"Cast Iron for Nitriding," by J. E. Hurst, Litchfield, Staffordshire, England.

"Hardenability of Cast Iron," by J. W. Murphy and W. P. Good, University of Michigan, Ann Arbor, Mich.

"Microstructure and Physical Properties of Cast Iron," by A. L. Boegehold, General Motors Corp., Detroit, and V. A. Crosby, Climax Molybdenum Co., Detroit.

"Wear Testing," by P. S. Lane, American Hammered Piston Ring division, Koppers Co., Baltimore.

"An Improved Method of Making Test Bars," by A. I. Krynitsky and C. M. Saeger Jr., Bureau of Standards, Washington.

"Some Steel Works Castings," by J. Roxburgh, Davy Bros. Ltd., Sheffield, England.

"Heavy Section High Strength Irons," by V. A. Crosby and E. R. Young, Climax Molybdenum Co., Detroit.

"High Strength Cupola Iron Practice," R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

"Titanium in Cast Iron," by E. R. Starkweather, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

"Shrinkage in Malleable Castings for Fittings," by F. B. Riggan, Stockham Pipe & Fittings Co., Birmingham, Ala.

"Physical Tests of Heat Treated and Fully Annealed Malleable Irons," by R. Schneidewind and A. E. White, University of Michigan, Ann Arbor, Mich.

"Selection of Annealing Cycles and Furnaces for Annealing Malleable Cast Iron," by A. F. Landa, Central Scientific Institute for Machine Production, Moscow, U.S.S.R.

"Sand Control in a Malleable Foundry," by E. Zirzow, National Malleable & Steel Castings Co., Cleveland.

"Developments in Melting Malleable Cast Iron," by W. R. Bean, Whiting Corp., Harvey, Ill.

"Casting 30 Per Cent Cupronickel," by T. E. Kihlgren, International Nickel Co., Bayonne, N. J.

"X-ray as an Aid in the Production of Aluminum Castings," by George Stoll, Bendix Corp., South Bend, Ind.

"Problems in Bronze," by Harold J. Roast, Canadian Bronze Co., Montreal, Canada.

"Practical Applications of Sand Control in Nonferrous Foundries," by A. C. Arbogast, Northern Indiana Brass Co., Elkhart, Ind.

"Some Fundamentals in Nonferrous Sand Control," by G. K. Eggleston, Detroit Lubricator Co., Detroit.

"A Study of Nonferrous Sands," by H. W. Dietert, H. W. Dietert Co., Detroit.

"Designing for Steel Castings," by R. A. Bull, Chicago.

"Specifications for Steel Castings," by E. W. Campion, Bonney-Floyd Co., Columbus, O.

"Cement as a Bonding Material," by C. A. Menzel, Portland Cement association, Chicago.

"Sand Control as Related to Steel Casting Production," by Charles Fuerst, Falk Corp., Milwaukee, Wis.

"Apprentice Training," by Macon P. Miller, Lynchburg Foundry Co., Lynchburg, Va.

"Apprentice Training," by K. P. Crowell, Caterpillar Tractor Co., Peoria, Ill.

"Apprentice Training as Viewed by a Graduate Apprentice," by Carl F. Haertel, Falk Corp., Milwaukee, Wis.

"Foreman Training," by A. D. Lynch, Hammond Brass Works, Hammond, Ind.

"Insulating Refractory Brick; Their Properties and Application," by A. V. Leun, Bethlehem Steel Co., Bethlehem, Pa.

"Insulating Refractories," by Dr. George A. Bole, Ohio State university, Columbus, O.

"Cupola Refractories," by H. S. Austin, Buick Motor Car Co., Flint, Mich.

"Job Evaluation for Rate Setting," by Bertram Miller, General Electric Co., Erie, Pa.

"Time Study in the Foundry," by H. C. Robson, Link-Belt Co., Chicago.

"Durability of Foundry Sands," by C. E. Schubert, University of Illinois, Urbana, Ill.

"Control of Core Hardness," by H. W. Dietert, H. W. Dietert Co., Detroit.

In addition to those papers a number of committee reports will be presented as follows:

"Shrinkage in Malleable Cast Iron," "Recommended Practice on Nonferrous Metals," "Analysis of Defects in Nonferrous Castings," "Methods for Producing Steel for Castings," "Steel Coupon Tests," "Developments in Heat Treatment of Steel Castings," "Survey of Report of Iron and Steel Institute Committee on Steel Castings Research," "Steel Foundry Sand," "Joint Committee on Foundry Refractories," and "Sand Research."

Polish Foundrymen Change Name

The founders section of the Polish Technical association recently was dissolved and in its place a new organization was formed to represent the foundrymen of Poland as a member of the International Committee of Foundry Technical associations. The new organization has taken the name of the Technical Association of Polish Founders (Stowarzyszenie Techniczne Odlewnikow Polskich), and its headquarters will be located at Warsaw, Politechnika, Zaklad Odlewnictwa, ul. Polna 3. The provisional council of the association includes K. Gierdziejewski, president; A. Lenartowicz, general secretary; and St. Ambrozewicz, treasurer.

To Print Directory

Gray Iron Founders' Society Inc. will issue a printed directory of its membership. This should prove a useful guide to the purchaser of gray iron castings.

Index Available

AN INDEX of all articles published in THE FOUNDRY during 1936 and giving a complete reference and cross reference to the material which has appeared in each of the issues, has been prepared for distribution. Readers who bind or preserve the back issues of this publication will find the index of great value in referring to articles which have been published. A copy of the index will be mailed free of charge to any subscriber who requests it from THE FOUNDRY, Circulation Department, Penton Building, Cleveland.

VETERANS OF '23

EVEN THE SAND STRIPS SHOW NO SIGNS OF WEAR

J. H. BIGALOW, PRESIDENT — C. A. HEISLER, VICE PRES. TREAS. & MGR. — THOS. FLETCHER, SEC'Y & ASST. MGR.

EST. CHAGRIN FALLS 1844
DESTROYED BY FIRE 1865
REBUILT AT CHAGRIN FALLS 1870
DESTROYED BY FIRE 1892
REBUILT AT RAVENNA 1893

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HARDWARE-TOYS-LIGHT CASTINGS
RAVENNA, OHIO

December 24th, 1936

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Truscon Ave.,
Cleveland, Ohio
Att: Mr. Perreri, Pressed Steel Division
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We are enclosing an order for 125 Steel Flasks, same as previously ordered in 1923. These Flasks have given thirteen years of continual service and at the present time are in excellent condition.

We trust these new ones will give the same good service.

Your prompt attention to this order will be greatly appreciated.

Yours very truly,
THE A. C. WILLIAMS COMPANY
James B. Heisler

JBH:AP

AMERICAN TOYS

STILL IN EXCELLENT CONDITION

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TRUSCON-IZE

WITH TRUSCON ALLOY STEEL FOUNDRY FLASKS

Common Sense Cost Estimating

(*Concluded from page* 33)

statistical information on the estimate sheet (Fig. 3). Note: This portion of the estimate sheet is to be arranged to suit the needs of individual companies.

2—Estimate:

A—Yield in good castings (per cent of good castings of total melt).

B—Production (pounds) per day separately for coremaking, molding and cleaning (brush, grind, chip).

C—A fair percentage as a provision for scrap.

D—Per cent of profit on invested capital to be used.

E—Delivery cost (if any).

F—Metal mixture to be used and indicate the percentage of pig iron content also the price of pig.

By the establishment of costing tables as shown in Fig. 3, the clerical cost of estimating is reduced considerably, particularly in foundries where it is customary to consider production on the basis of tonnage per day as will be noted by the red lines indicating the source of entries to the estimating sheet.

In establishing these costing tables, variances in operation costs, caused by fluctuating metal prices and operating conditions, require separate tables for:

A—Melting — different mixtures and methods of melting.

B—Coremaking—different methods.

C—Molding—different floors.

The costing data for each of these estimating methods being based upon the normal capacity to produce, in each department and subdivision of department, reflects practical accuracy in estimated costs and the arrangement as simple to use as consistent with dependable results.

Buffalo School Has Foundry Course

A course in foundry work is included in the curriculum of Technical high school, Buffalo. It is required for students enrolled in the machine design classes and optional for those in the college preparatory courses. The course is prepared to give machine design students practical knowledge to assist in their design theories.

Herman Muelke, counselor and senior instructor in the mechanical design division, has made many visits to foundry centers and believes good apprentices are much in demand. Alexander Birnie, the instructor, has devoted much of his time to the study of foundry work. The classes has won the recognition of the New York state education department and the Buffalo chamber of commerce, which proposed that a course be introduced into the night session.

Talks On Nonferrous At Philadelphia

R. J. Keeley, chief metallurgist, Ajax Metal Co., Philadelphia, discussed "Some Problems Encountered in the Nonferrous Foundry," at the Feb. 12 meeting of the Metropolitan Philadelphia Chapter of the American Foundrymen's association, held at the Engineer's club. Mr. Keeley presented specific cases of actual experiences and the methods proposed by which the problems were solved.

The speaker stated that these problems resulted principally from improper selection of metals, wrong melting methods and faulty foundry practice. A short talk on Abraham Lincoln was given by Hon. Utley E. Crane, judge of the municipal court, as an after dinner feature.

Operate Foundry for Art Students

A foundry in which art students may transmit their work in sculpture from clay to bronze has been put in operation at Temple university on the grounds of the Stella Elkins Tyler school of fine arts in Elkins park, Philadelphia. Officials say this is the first project of its kind in the country. Borin Blai, sculptor who directs the school, says a student otherwise would know only half his job. The new foundry is housed in an old storehouse equipped with a refractory furnace and other facilities. The various metals and alloys will be tested in cooperation with the school of metallurgy at the university.

Bureau of mines, department of the interior, Washington, recently has published bulletin 394 which constitutes Part VI of "Contributions to the Data on Theoretical Metallurgy." This bulletin is entitled "A Revision of the Entropies of Inorganic Substances—1935" and is by K. K. Kelley. Copies of the bulletin may be secured from the superintendent of documents, Washington, for 10 cents.

Book Review

Gray Cast Iron, by John W. Bolton, cloth, 400 pages, 6 x 9 inches, published by the Penton Publishing Co., Cleveland, and supplied by THE FOUNDRY, Cleveland, for $5 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

This is the first complete book on the subject of gray cast iron, and gives in a clear, concise manner the modern conception of that well known and widely used material. It is written in a simple, brief style, and presents all the essentials relative to general manufacture, structural metallurgy, and engineering and physical properties.

The book is divided into 23 chapters under three main headings. Chapter I is the introduction which is followed by Part I on general manufacture containing chapters on raw materials, melting processes, casting defects, and design, respectively. Part II on structural metallurgy contains ten chapters which relate to general microstructure, iron and carbon, effects of silicon and manganese, effects of sulphur and prosphorus, effects of nickel, chromium and molybdenum, effects of other elements, effects of gases, superheating, pouring and cooling rate, and heat treatment.

Part III contains eight chapters which cover general engineering properties, general physical constants, static strength and elasticity, dynamic strength and elasticity, machinability and wear, effect of temperature on engineering properties, corrosion, and specifications. The book has an excellent subject index which aids materially in locating any particular phase, and also a name index. While much of the text is technical in nature, it is written so as to be understood easily, and the book is a valuable addition to the library of every foundryman and engineer in the gray iron field.

Health Talk Given At Detroit

"Safety and Hygiene in the Foundry" was the subject of a talk given by E. O. Jones, director of safety and industrial hygiene, American Foundrymen's association, at the Feb. 18 meeting of the Detroit Chapter, A. F. A., in the Fort Shelby hotel. His discussion included a consideration of silicosis, safety equipment and recent investigations into industrial hygiene.

F. S. Mallette of the industrial disease research laboratories, Detroit, contributed to the discussion and explained the various bills which have been proposed by the Michigan legislature in regard to occupational diseases.

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Cast Shafts Possess Advantages

(*Continued from page* 30)

damping capacity which is used in comparing materials of different moduli of elasticity is calculated from data obtained from testing a solid round bar machined from the material in question to these dimensions in a Foepple-Pertz damping testing machine: 11¾ inch long, reduced section 6½ inch x ½ inch diameter, with square ends.

This free vibration method of determining specific damping capacity as well as other methods is ably described in a paper by G. S. Von Heydekamp, published in *Proceedings*, American Society for Testing Materials Vol. 31, 1931. In his discussion he states that "the damping method seems to furnish a novel and promising tool for investigating the range of low stresses which is the one mostly used in service." He applies the name *dynamic ductility* for the damping capacity to distinguish it from static ductility or elongation since both are a measure of plastic behavior.

Material is Less Sensitive

He further states, "The dynamic ductility as measured by the damping capacity seems to be related to the 'tenderness' effect." In other words, a material of higher damping capacity is less sensitive to the influence of surface notches or sudden changes in cross-section, which strongly affect the fatigue strength of *dynamically* brittle materials.

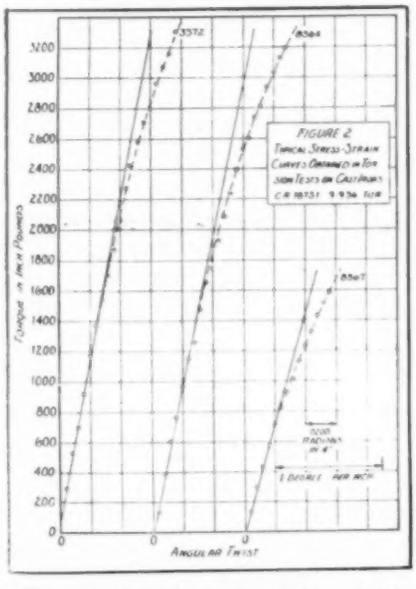


Fig. 7—Graphical representation of torsional properties

Materials having high damping values can be deformed to a higher degree than Hooke's law predicts without being damaged. In this way *stress raisers* may be compensated by internal yielding, the amount of which is measured by damping capacity.

In a paper by G. R. Brophy and E. R. Parker published in *Transactions*, the American Society for Metals December, 1936, entitled "Damping Capacity—Its Variation and Relation to Other Physical Properties" the authors state that, "in any metal, damping capacity may vary greatly depending upon such factors as stress, chemical composition, structure, heat treatment, mechanical work and especially temperature. Combinations of these factors, which are usually encountered, complicate the interpretation of damping capacity determinations until the influence of each is understood."

Action of Metal Under Stress

Their conclusion is as follows: "The study of damping capacity as a property of metals is, to say the least, extremely interesting and offers a means of understanding better the action of metals under stress. It is not proposed here that the damping test be used as a substitute for others, but in conjunction with them, and possibly as a means of surveying rapidly a large number of materials and thereby eliminating long and tedious tests on the unpromising.

"As a property, it is of greatest importance in the control of the deflection and whipping of rotating shafts, and the surging of springs. Its variation with temperature appears to be a controlling factor in the fatigue and creep resistance of steel. Other relations will undoubtedly be found as there remains a number of problems to be investigated; for instance, a study of the relation of damping capacity to work hardenability, impact resistance, the relief of internal stress and others."

It is evident that inherent vibration damping capacity or dynamic ductility is an important physical attribute in a metal to be used as a crankshaft material. Little information is available with respect to the correlation of chemical analysis, microstructure, and physical properties of cast iron, and their influences on the inherent damping characteristics.

A comparison of vibration damping curves taken from steel and cast irons as shown in Fig. 5 are interesting from a practical standpoint if not academically in so far as they show the relative merits of the various materials. It is hoped that in the near future work that is now in progress will be made available in the literature.

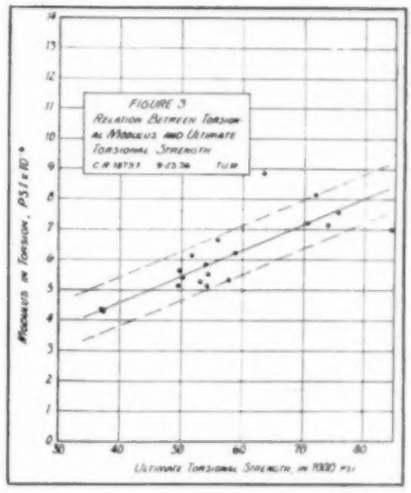


Fig. 8 — Torsional properties of some cast irons

For the present we can only assume that a crankshaft made of a material of high damping capacity with moderate strength may have a greater effective strength and life expectancy than one made from a material with much higher strength having a low damping capacity.

Designers have eliminated the critical torsional oscillations to a certain extent by means of mechanical vibration dampners properly installed in the engine, but these are usually only efficient at normal operating speeds, and where an engine is operated at a higher critical period for a sufficient length of time resonance failure is more likely to take place in a material of low damping capacity than one of high damping capacity. Where the impulse energy is restricted to small amplitudes by internal frictional dissipation, well within the fatigue range, failure will not be likely to occur.

Compare Torsion and Tensile

Much of the current development of cast iron for applications, as in crankshafts and camshafts, has been carried on with little specific informaton on the torsional properties of this material. Figs. 6, 7, and 8 show graphically the torsional properties in comparison with the tensile strength of some 20 different irons, which were recently investigated. The composition and physical properties as obtained on 9 of these irons are listed in Table II.

Composition apparently affects the torsional strength in the same way that it affects tensile strength. A straight line relation has been established which may be obtained by the equation:

$$x = 1.241\ y + 4600$$

Where x = ultimate torsional strength, and y = ultimate tensile strength. As shown in Table II, a high shearing modulus of elasticity

is associated with high torsional strength.

The torsion test specimens were machined from arbitration bars with the reduced section approximately 5 inch long and 0.750 inch in diameter. Standard methods of testing and standard formulas for calculating the various physical properties were used. The relatively high values of cast iron in torsion are interesting from the standpoint of crankshaft design.

Use Bronze Casting For Repairs

By N. K. B. Patch

Occasionally the question arises in an emergency, in a break-down job, or in a location far from the source of supply, whether a brass or bronze casting might not take the place of a malleable iron casting. Some nonferrous alloys commonly cast in foundries today have the resistance to shock, strength and other physical properties equal to an in some instances greater than those presented by malleable iron. Of course, the cost of the nonferrous castings is much higher; first on account of the cost of the virgin metals in the alloy, and second on account of the extra metal which has to be melted for the large feeding risers required on all high strength bronzes.

Gun metal containing 4 per cent zinc instead of 2 per cent produces strong and satisfactory castings provided they are not subjected to excessive shock. This metal is made up of: Copper, 88 per cent; tin, 8 per cent; and zinc, 4 per cent.

For resistance to severe shock there is nothing to equal the aluminum bronzes. However, production of aluminum bronze castings involves expense and special experience to say nothing of the fact that scrap cannot be used. Aluminum bronze also requires very large feeding risers to compensate for shrinkage. The metal is strong, and as with all strong bronzes it shrinks to a material extent in cooling.

There are bronzes made today with 2 to 3 per cent nickel added to the copper, tin, zinc alloys that are quite strong and relatively hard after proper heat treatment. Heat treatment represents additional expense. It requires special equipment to secure accurate control of temperature and therefore, probably would not be available where castings of this kind would be ordered only intermittently.

The author is familiar with many instances where good bronze and brass castings have been substituted for cast iron in agricultural machinery. Also where manganese bronze castings have given eminently satisfactory service when substituted for malleable or even some of the mild steel castings in agricultural implements. A good grade of this material contains: Copper, 57.50 per cent; tin, 0.75 per cent; zinc, 40 per cent; iron, 1.00 per cent; aluminum, 0.50 per cent; and manganese 0.25 per cent.

High grade manganese bronze ingot may be secured from the nonferrous smelters. After a little experimenting the foundryman should experience no difficulty in making good castings from the alloy. Important features include the necessity of providing risers sufficient in number and volume to feed the castings as they pass from the liquid to the solid state; melt the metal rapidly, and replace with new zinc, the zinc that has vaporized during the melting process.

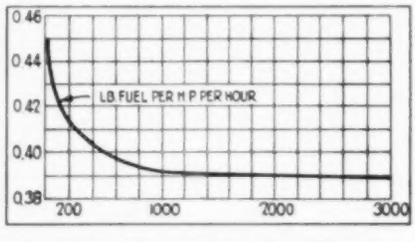
Diesel Performance In Foundries

By W. F. Schaphorst

How much fuel would a diesel engine consume if it were installed in our foundry is a question that often is asked by officials who are considering its application for power purposes. Too often the question is side stepped by salesmen who are afraid of committing themselves. They reply, "It all depends upon the size required," or words to that effect, and the prospective user is mystified by the intricateness of the situation.

In an effort to answer the above question definitely the author has gathered data on fuel consumption by modern diesels of numerous sizes and has developed the accompanying curve. This curve tells at a glance what good diesels are doing today, the horsepower varying from the smallest sizes up to and including 3000 horsepower.

For instance if your requirements are small—50 horsepower or even less—you can figure on a fuel consumption of 0.45 pounds per horsepower per hour with a modern engine. If you need a 100 horsepower diesel the consumption will be about 0.42 pound per horsepower hour.



Curve showing the fuel consumption of diesel engines in pounds per horsepower per hour

The curve shows that with increase in engine size the fuel consumption improves rapidly from the smallest sizes to 200 horsepower. From 200 to 1000 horsepower the improvement is less rapid, and from 1000 to 3000 horsepower the improvement is slight being practically 0.39 pound per horsepower per hour for all of the sizes in that range.

To determine the efficiency of any engine size, with any fuel, multiply the B.t.u. value of the fuel per pound by the number of pounds per horsepower per hour and divide the products *into* 2546.

For example if the fuel contains 20,000 B.t.u. per pound and you will require a 500 horsepower engine, the chart shows that you must multiply 20,000 by 0.40, which gives 8000 as the product. Now divide 2546 by 8000 and it will be found that the engine will have an efficiency of 31.8 per cent, which is a high efficiency as compared with most engines of other types. It means that 31.8 per cent of the heat contained in the fuel will be converted into work. Even at 0.45 pound of fuel per horsepower per hour, other conditions being the same, the efficiency will be 28.3 per cent, which is a *high* efficiency.

Book Review

Modern Steel Founding (Moderne Stahlgiesserei), by B. Osann, fabrikoid, 261 pages, 6½ x 9¾ inches, published by Julius Springer, Berlin Germany, and supplied by THE FOUNDRY, Cleveland, and in Europe by the Penton Publishing Co. Ltd., London.

This volume, which is in German, is designed for the practical man, for college students and apprentices, and for self instruction. It is divided into nine chapters covering various phases, and the author has endeavored to condense the subject as much as possible. Chapter I, the introduction, outlines the procedure of steel production briefly, presents historical data and statistics on production, and describes the general principles employed in making steel. Chapter II discusses briefly crucible melting while Chapter III deals with melting in the open-hearth furnace.

Steel production in the small or baby converter is discussed in Chapter IV, and Chapter V is concerned with the principles of electric melting. Melting in the arc-electric furnace is described in Chapter VI, and in the induction electric furnace in Chapter VII. Properties of plain carbon and alloy steels are presented and discussed in Chapter VIII. Chapter IX describes the production of steel castings, cleaning, annealing and heat treatment, welding and cost accounting.

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Have A Name For It

(*Concluded from page 27*)

with the African midsummer sun beating down on a corrugated iron building, was anything but a picnic. Adding the phosphorus to the metal did not increase our comfort. Stick phosphorus was used and we had a free exhibition of fireworks.

With the aid of several men from a neighboring mine we lifted the pots out of the furnaces. The larger ones were raised by a chain block attached to a trolley. Nothing unusual happened until the metal entered the risers. Then something went wrong. The metal sank in the risers and what sounded like a combined earthquake and powder factory explosion broke loose under our feet. Needless to say, everyone jumped through the nearest door or window.

After the excitement died down, the cope was raised and the core was lifted out of the mold. According to expectation it was found that the pressure had forced the metal into a crevice in the earth, possibly formed by the incessant blasting carried on in the lower regions. Whatever the cause, that particular spot is the resting place of a ton of good phosphor bronze.

When I asked George if he still believed in hoodoos, he told me not to ask foolish questions. Had I not seen enough that day to convince me?

Four days later the mold again was ready, and we had the metal in shape to remove from the furnaces. George warned me to watch out.

The pots came out without the slightest trouble. I was assigned to skim the largest one slung from a chain block. In this position I was opposite one of the pots and quite near the largest furnace. With a wall at my back and the mold on my left, I was fairly well hemmed in.

While I was pulling the dross from the surface of the metal, the pot was tipped forward a little and some of the metal spilled on the floor. I turned my head to avoid the splash, and at the same moment I felt my arm caught in a grip of steel. I was sent headlong onto the hot furnace plates, and then given a kick, which sent me rolling into the pit in time to escape an awful splash up above.

The two men on the shank of the pot I was skimming, had let go when the first metal splashed on the floor. George, standing near me and seeing what little chance I had to escape, had hurled me into the pit to suffer a few burns and many bruises rather than to receive the full force of the molten metal.

With one pot gone we had not sufficient metal left to fill the mold and had to postpone the job until the following day. This time we met with no difficulties whatever.

However, the hoodoo still hovered in the vicinity. Reporting for work the next day we found the substantial building of the night before, a mass of junk—burned down during the night.

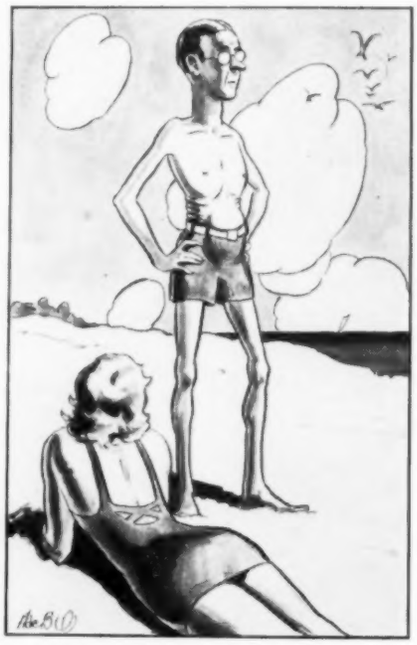
The casting was found among the debris, and turned out to be perfect in every way.

A new building was erected on the same site and fitted up in a modern manner. In a short time business again was proceeding as usual.

On the evening previous to my departure from the country, I called on my friend George to bid him good-bye. I found him with his family squatting around their salamander cooking supper under the stars.

George was in an expansive mood that evening, and when I brought up the subject of his pet hoodoo, he told me one of the strangest tales I ever have heard. Impossible of course, preposterous—and yet—I wonder!

Faked Foundry Facts



A Skeleton Pattern

Chapters of A. F. A., A. S. M. Meet

A joint meeting of the Quad-City Chapter of the American Foundrymen's association and the Tri-City Chapter of the American Society for Metals was held at Rock Island, Ill. arsenal Feb. 15. George Zabel, foundry superintendent, chief chemist and metallurgist of the Fairbanks, Morse & Co., Beloit, Wis., discussed relationships between the foundry and engineering fields. He said that foundrymen have to think in terms of exactness of measurement, design of castings, soundness, prices and materials used. There is also the human side to his work and the pride he takes in working and making castings.

Mr. Zabel believes there is a certain lack of co-operation between the engineering departments and the foundry proper. The engineer should have sufficient training for a fundamental understanding of the making of castings, cores, materials used and the different castings. The foundrymen, on the other hand, should have an opportunity to get information from the engineer. The speaker believes this lack of co-operation is being eliminated gradually and a more mutual basis is becoming apparent in the two fields. He gave examples of how design has become important in the foundry industry, accompanied by fewer operations and less expense.

To Discuss Foundry Problems

The Porcelain Enamel institute forum will be conducted at the University of Illinois, Urbana, Ill., on May 5 to 7. Of particular interest to foundrymen will be one of the group sessions to be held at 1:30 p. m. on Friday, May 7 which will be devoted to cast iron. Topics to be discussed are foundry practice, preparations of castings for enameling and processing of leadless cast iron enamels.

To Move Offices

Westinghouse Electric & Mfg. Co. will move its Pittsburgh office and some of its general offices, now located in East Pittsburgh, to the Union National Bank building in Pittsburgh. Nine floors of the building will be occuped by the company about May 1. The district, subsidiary district and headquarters offices including executive, legal, industrial relations, sales and accounting departments, will be located centrally in the building to facilitate operation.

ADVERTISING PAGES REMOVED

Difficult Jobs Are Specialty

(*Continued from page* 24)

rolled over. No parting sand is applied to the joint before the cope is rammed in place. The patterns then are pulled through openings in one end of the flask, after which the openings are plugged with short pieces of dry sand core, bearing on the inner end a serial letter or number to identify the test bar

Fig. 8—Inside and outside cores for brake drum

later. Metal is poured directly into each bar mold through a small vertical gate located near one end. A similar vertical opening near the other end serves as a riser. In this manner the test bars are made straight and true without either swells or fins.

Cylinder sleeves or liners are made in a wide variety of sizes and compositions. Some are molded in rectangular, while others are molded in circular metal flasks. A typical group of these molds is shown in Fig. 2. Early experiments indicated the advisability of gating the castings at the bottom principally to prevent the erosion of sand from the falling stream of metal. This method necessitated the use of a three-part flask, a cope, cheek and a shallow drag to contain the core prints. Later manipulation and composition of the sand resulted in a product sufficiently strong to resist this erosion and which permits the use of gates at the joint between cope and drag as shown in the illustration. Metal is poured into a sprue close to the edge of the flask. Passing through a strainer core at the bottom the metal flows through a horizontal runner in the joint face of the cope and into a spherical cavity, half in the cope and half in the drag joint. From the cavity in the center of the drag joint the metal flows through a single small gate into each of the four mold cavities. The spherical cavity in the center serves as a dirt catcher, a uniform distributor of the metal and a feeder. By maintaining high permeability and low moisture content in the sand no venting with a wire is necessary to prevent the metal from boiling or bubbling in the mold. These molds and practically all the molds in this foundry are jolted and squeezed on machines made by the Milwaukee Foundry Equipment Co., Milwaukee, the International Molding Machine Co., Chicago, and the Arcade Mfg. Co., Freeport, Ill.

Sleeve molds are made in green sand, but the cores are dried and are accurately located in tapered prints top and bottom. In the core room the cores are made in halves and dried. Then they are placed joint side up in the device shown in Fig. 6, a turntable which carries the cores under a disk grinder. When removed from the jig, each half core presents a true half circle in cross section, and consequently each pair of half cores forms a true circle in cross section when pasted together. The castings are machined on the inside and on the outside. The amount of finish is held to close limit, hence the necessity of providing a true mold and core.

On account of the high temperature and the penetrating quality of some of the alloy irons, it has been found advisable to coat the cores with silica wash, the material usually employed in steel casting foundries. Silica flour and molasses

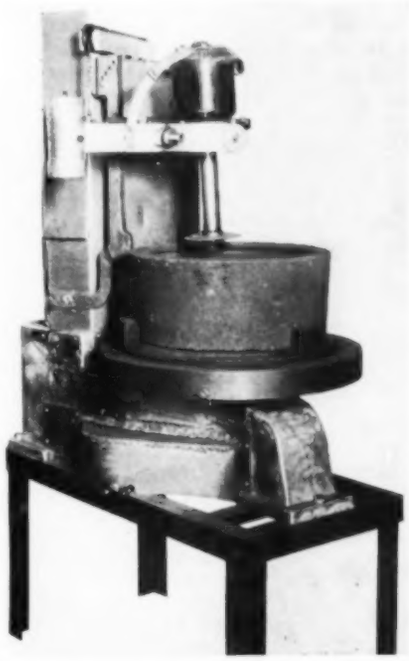


Fig. 9—Specially developed machine for cutting spiral grooves in ring cores

water are mixed in a large container equipped with an eccentrically operated agitator arm which thoroughly mixes the ingredients and constantly maintains the mixture at the proper degree of consistency. The device, as with many others devoted to special purpose in the plant, was developed by the company's engineering staff.

Typical of the ingenuity displayed in this respect is the machine shown in Fig. 9 for forming spiral radiation vanes on the outside of brake drum castings.

The core designed to form the outside wall of the mold is made and dried as a plain one-piece ring and the vanes or ribs are cut in the inside face by a thin abrasive wheel as shown in Fig. 9. The core mixture contains 90 per cent sharp

Fig. 10—Test bar pattern is pulled through opening in end of special flask

sand, 10 per cent bank sand bonded with oil in the proportion of 1 part oil to 50 parts sand. The sand is rammed a little harder than usual to prevent the core from sagging in the green state. The bank sand and a small amount of cereal binder also assist the core in maintaining the proper shape while green and in the preliminary drying stages. The corebox is mounted and the sand is rammed on a jolt rollover machine.

After the cores are dried they are placed in succession on the vane cutting machine which through suitable gearing is set to cut the desired number of grooves. Each groove is independent of the others and extends spirally in one complete turn from top to bottom of the core. While the core is revolving, the wheel cuts one groove from top to bottom. The core then is re-set and the wheel cuts a second groove from bottom to top. The process is repeated until the required number of grooves have been cut in the inside face of the ring core.

Green sand molds for the drums are made on a pair of jolt, squeeze, rollover machines located close to each other, one for the copes and

the other for the drags. One of the molds ready for closing is shown in Fig. 4, while a floor of the molds set up for pouring is shown in Fig. 1. To conserve space in some instances, the molds are stacked with the upper tier slightly overlapping those comprising the lower tier.

Metal for crankshafts and other castings presenting exceptionally peculiar characteristics is melted in a 1-ton electric furnace made by the Detroit Electric Furnace Co., Detroit. The remainder, approxi-

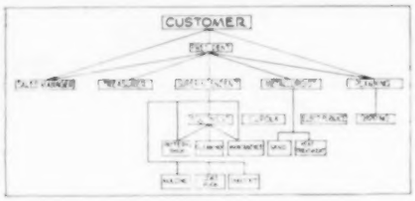


Fig. 11—Organization chart through which foundry functions

mately 75 per cent of the total tonnage, is melted in the cupola under the direction of a skilled metallurgist. Molten metal from the cupola flows into a forehearth to insure a perfect and homogeneous mixture. A skimmer in the trough between cupola and forehearth removes the slag.

Bibliography Is Available

American Foundrymen's association recently has made available a series of mimeographed sheets entitled "Bibliography on Sand Testing and Control." That bibliography contains mention of approximately 100 reports and papers on sand testing and control which have appeared in the *Transactions* of the American Foundrymen's association from 1923 through 1936.

Forms Company

Mine Safety Appliances Co., Pittsburgh, has formed the Mine Safety Appliances Co. of Canada Ltd., which has taken over the personnel and business of the safety department of Drummond, McCall & Co. Ltd., Montreal, Que. The safety department of Drummond, McCall had been agents for the Mine Safety company since 1918. The new company is located at 802 Railway Exchange building, 637 Craig street, Montreal, and is in charge of R. Morris, former safety division manager of Drummond, McCall & Co. R. M. McCall will represent the company in Nova Scotia with an office and warehouse at New Glasgow.

Study Problems of Ingot Making

J. F. Ednie, assistant chief metallurgist and director of research, Federated Metals division, American Smelting & Refining Co., Pittsburgh, discussed "Some Problems of Brass Ingot Manufacture as Related to the Foundry," at the February meeting of the Pittsburgh Foundrymen's association in the Norse room of the Fort Pitt hotel on Monday evening, Feb. 15. The meeting was unusually well attended.

Mr. Ednie told how the manufacturer of brass ingots copes with the impurities found in brass scrap. Prior to his talk he showed moving pictures depicting the manufacture of copper, brass, and white metal ingots, showing the receiving and sorting of material, operations in the furnaces, refining and pigging of white metals, and the laboratories.

Impurities found today in brass scrap include iron, antimony, phosphorus, nickel, aluminum, and other substances, Mr. Ednie pointed out. Antimony and nickel can be reduced by dilution; phosphorus, aluminum and manganese are eliminated by oxidation; sulphur is more difficult to remove.

Concerning the effects of these impurities in casting an ingot, Mr. Ednie said iron and antimony have no bad effects, while nickel up to ½ per cent is unharmful. The effect of sulphur is unpredictable; phosphorus and manganese are usually well removed and present no problems, but aluminum is harmful, according to the speaker.

"The best advice to the foundryman is to study his own individual troubles," said Mr. Ednie. "I don't believe that in the same pot of metal you are likely to find trouble from both shrinkage and gases at the same time."

The leader of discussion was H. B. Reed, metallurgist for Westinghouse Air Brake Co., Pittsburgh. The discussion period drew some interesting comments from both nonferrous and ferrous foundrymen.

Book Review

A.S.M. Metals Handbook, 1936 Edition; cloth, 1540 pages, 6 x 9 inches; published by American Society for Metals, Cleveland, and supplied by THE FOUNDRY, Cleveland, for $10 plus postage; in Europe by Penton Publishing Co. Ltd., London.

This, the fifth edition of the well-known handbook dealing with metallurgical practices pertaining to the manufacture, treatment and use of metals, is thoroughly revised and enlarged to bring it up to date and is the first edition to appear in conventional page size. Work of revision and compilation was performed by authors and subcommittees supervised by a handbook committee of the American Society for Metals. Over 2000 individuals and more than 40 subcommittes participated in the preparation of special reports and articles.

The text matter contains 1392 pages and 335 articles and two main sections, a ferrous section of 898 pages and 180 articles and a nonferrous section of 494 pages and 155 articles. Each section is arranged in the following divisions: General data, constitution of matter, structure, properties, testing, melting, casting, mechanical working, heat treatment, machining, grinding, welding, soldering, cleaning, equipment, and applications.

A committee of the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers prepared the material in the nonferrous section through a cooperative arrangement. Through the efforts of this group, a considerable amount of new information on the properties, technology and applications of nonferrous metals and their alloys has been made available.

Appoint Two Sales Representatives

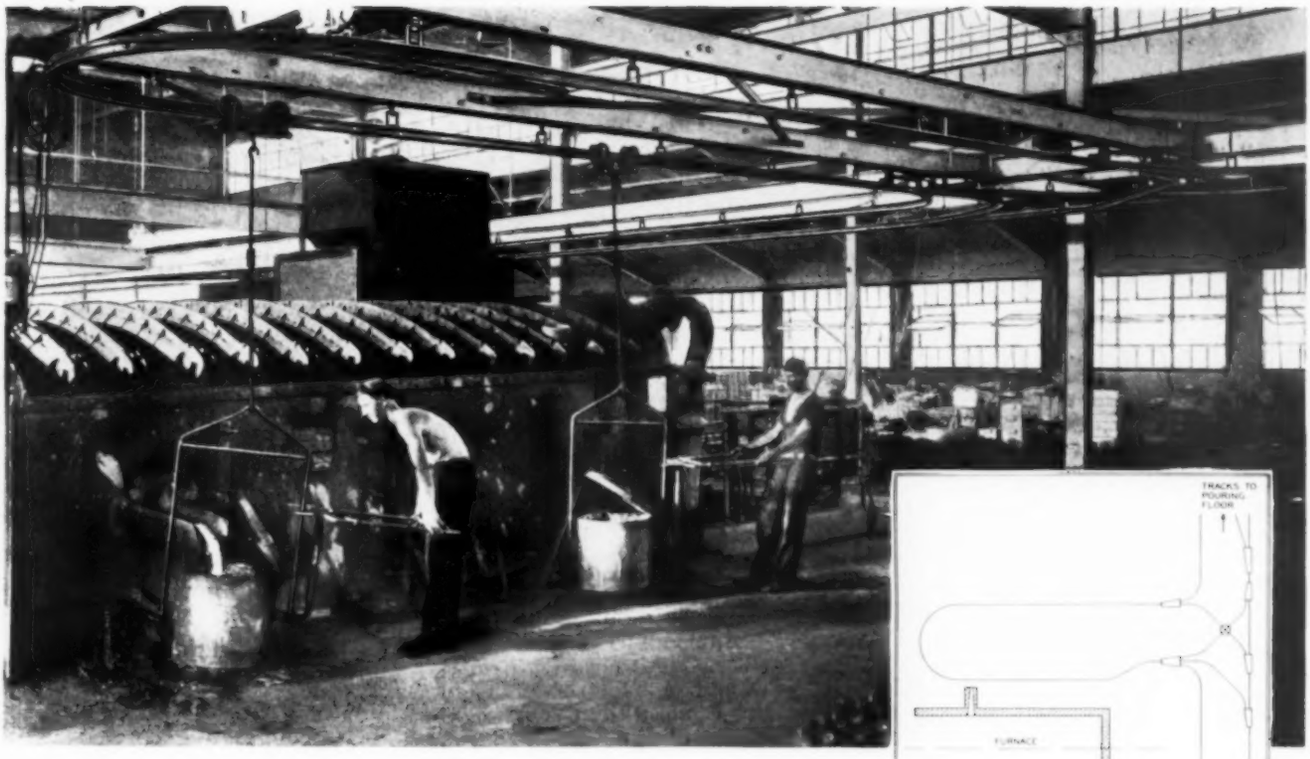
Claude B. Schneible Co., Chicago, recently appointed new sales representatives in the Milwaukee and eastern Pennsylvania territories. Paul J. Cnare will handle sales in Wisconsin and Minnesota from headquarters in Milwaukee. Mr. Cnare was associated formerly with General Motors Corp., in the Chevrolet gear and axle division.

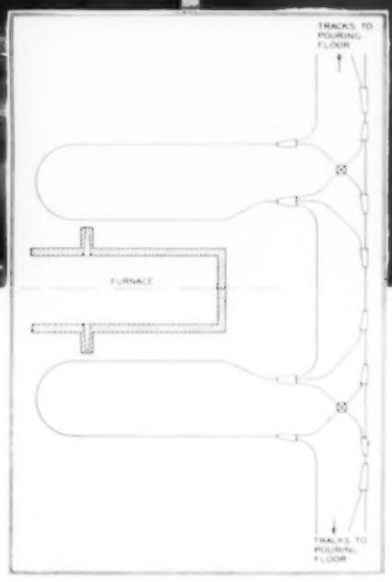
Charles C. Hermann, formerly of Deere & Co., Waterloo, Iowa, will be in charge of the Philadelphia office which covers eastern Pennsylvania, Maryland, Delaware and the lower New Jersey territory.

Foundation Formed

A new foundation has been established recently by the Lincoln Electric Co., Cleveland, which is dedicated to the encouragement of study and research for benefit of the arc welding industry. The new organization has been named the "James F. Lincoln Arc Welding Foundation." Dr. E. E. Dreese, head of the department of electrical engineering, Ohio State university, will give principal direction to the research and educational activities of the new foundation.

Fred M. Viles Co., Great Falls, Mont., has been appointed distributor in that territory for the Harnischfeger Corp., Milwaukee.





Engineered handling

for **LOW COST POURING**
GREATER PRODUCTION
IMPROVED CASTINGS

Send for this book

Used as a standard reference in many technical libraries.

Plans for handling foundry materials often mean the difference between profit and loss. Handling that involves considerable labor must be made easy and methods provided for quick transportation of hot metal from cupola to molds.

Time after time American MonoRail equipment is selected wholly upon the engineering skill demonstrated in the proposed installation plan.

With precision bearings for easy rolling trolleys and forgings for all wearing parts American Mono-Rail equipment produces the kind of handling recommended. Recent installations prove the value of modern layout. Let our engineers suggest ways of improving your handling system.

THE AMERICAN MONORAIL CO

13104 Athens Ave., Cleveland, O.

Serves Foundry Industry

(*Concluded from page* 25)

regard this as a buyers market. One in Chicago that had been losing its shirt on a job at 5 cents a pound threw out the patterns because the loss was too great. The patterns came back, with an increased order and at 7½ cents, just 50 per cent increase.

What business has the secretary of the American Foundrymen's association to talk about prices? Perhaps directly, none. But we all want to see this foundry industry live, not alone now, but through 1938, 39, 40 and far into the future. While we don't hold any truck with the type of thinking evidenced in a recent conversation when an otherwise sane foundryman remarked that he thought the thing to do was pay any high prices asked for material or labor, soak up the price on the customer and let this "crash come as quickly as possible." Nor do we believe that price fixing by collusion is necessary or wise.

To Make a Fresh Start

Let's know our costs, reduce our costs, set a fair price, sell our product with self respect and rebuild. And in the foreground, lets make enough in the foundry business to pay decent salaries and wages. Thats the sharp prong of the manpower dilemma.

Now as to manpower. What's happened?

Since the late, un-lamented depression, the foundry industry has lost many men. Some have died, some now operate gas stations, sell life insurance, etc. Some have reached the age of retirement, socially secure or otherwise. And the foundry industry has done a swell job of boondoggling for itself on apprentice training. Of course there are exceptions.

But in actively training to supply a real scarcity of men, the record is not creditable.

Further, as we get into more active business conditions, the foundries have many hampering obstacles. High pay for WPA work, easy-get on relief, better wages in nearby industry, more attractive working conditions in lines that compete for labor sales and management talent, application of physical examination to rule out the unfit. These and dozens of other conditions that you know more about than I do make the situation acute.

Training on the basis of teaching one man, one job may work in high production plants. It does in some classes of foundries. But, by-and-large, more training is necessary even to provide a reasonably capable foundry workman. Apprentice training is strongly urged by the A. F. A. Unless legislation limits activities of boys under 20 to prize fighting, playing baseball or getting married, apprenticeship should be made available and with adequate pay to youngsters.

Then in the operating executive posts, training again is necessary. Engineering brains are needed and must be bought. See that your men have the opportunity that awaits them in the technical papers, meetings and activities of the A. F. A. Encourage young men from neighboring engineering schools to enter your foundries. Give them a chance to learn your business, your problems and supply you with that technical background which foundry industry needs today.

Pay Adequate Wages

When training is made available, proper pay should follow. The foundry industry most certainly needs the brains—as well as brawn of men. Proper pay goes even further in providing the former.

What is the American Foundrymen's association offering in these fast moving times? What can you as foundrymen, and you as engineers get from the intensive, constant work of this 40 years young organization?

To get, you must give. That's fundamental. In the Chinese it is typified by the legend of the greedy man who entered the hereafter through the gate marked, "Within a cash becomes as ten thousands pieces of gold, and a minute is as ten thousand years." The newcomer said to the attendant, "Give me then but one cash." "In a minute," was the response.

The contributions of hundreds of fine minds finds expression in each technical gathering of the American Foundrymen's association. It's committees through constant work and effort advance standards of materials, methods and products. What use are you making of this exhaustless mine of information?

Further, the A. F. A. brings to the engineer knowledge of the properties, application and service of castings. How many of you, as engineers, are making use of this service to the improvement of your own production and machines?

But what is the benefit of dealing in details? What are the services of the American Foundrymen's Association, and how can it help you as individuals? Perhaps this can best be expressed by the statement of responsibilities of the organization, recently developed by a special policy committee and approved by the board. This constitutes a broad statement of principles, the blue print of our job as members of the association. The outline of A. F. A. responsibilities is as follows.

1. Extend A. F. A. membership to include 100 per cent of the progressive foundries in all branches of the castings industry.
2. Establish chapters as conditions justify and through well-planned and concerted effort, raise and maintain the standard of work of present chapters for the foundry industry.
3. Sponsor a broad, comprehensive program for unity of action on matters of public policy affecting the foundry industry.
4. Assume leadership in making industry more articulate to the end that the increasing utility of all classes of castings may result advantageously to all persons engaged in the foundry and related industries, and to all users of foundry products.
5. Continue to advocate and provide direction for technical training of apprentices, employes and supervisory forces.
6. Continue to encourage, direct, and amplify technical research on the products of the entire castings industry.
7. Point out obsolescence and show advantages of modernization.
8. Coordinate and disseminate through A. F. A. state policy committees, information helpful in securing equitable occupational disease legislation.
9. Foster and promulgate engineering codes for industry use covering suppression and control of foundry dust, gases and fumes.
10. Co-ordinate and disseminate information of assistance in combating in every legitimate way unfair compensation and occupational disease rates, and when advisable provide some form of group insurance for members of the foundry industry.
11. Sponsor the development of workable code of ethics for the foundry industry.
12. Stimulate and provide direction to broaden the knowledge of those engaged in the design on the utility of cast products.
13. Sponsor co-operative effort on the part of all interests in promoting increased uses of castings through directing attention to merit and application of cast products.
14. Co-operate in effecting acceptable standards for materials and equipment used in foundries.
15. Stimulate and direct improvement of pattern equipment.
16. Continue to stimulate investigations and education in the matter of costs.
17. Assist in developing for each of the casting groups some system of selling by price classifications.

ADVERTISING PAGES REMOVED

NEW EQUIPMENT . . . . .

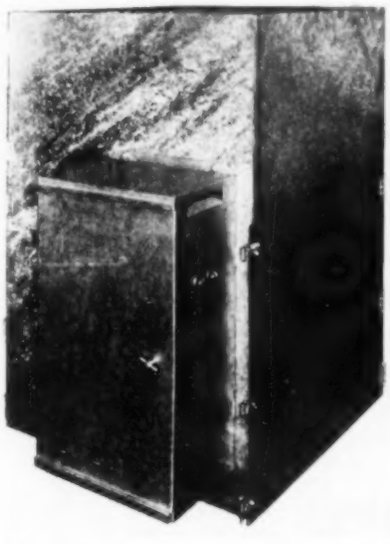
for foundries

Precipitates Dust Electrically

The electrostatic precipitor, shown in the accompanying illustration, is a development of Westinghouse research and has been applied to the industrial air cleaning field by the Pangborn Corp., Hagerstown, Md. It is claimed that its use in industry provides the advantages of dust and fume collection by electrical means within the range of general application at economical installation and operating costs.

Distinguishing feature of the development is its division into two parts, the ionizing chamber and the precipitation chamber. Complete, the unit consists of three essential parts, the collector plate cells, the ionizing assembly and the power pack.

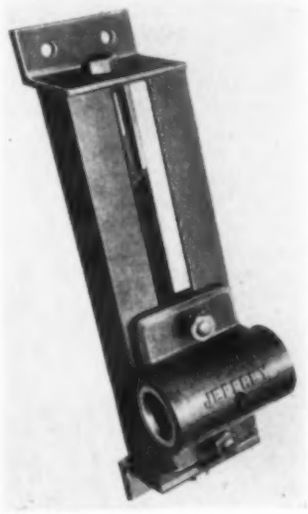
Any particles in the air passing through the ionizing chamber are charged and, upon entering the precipitation chamber, the electrostatic field between the plates exerts a force which drives the particles to the grounded plates where they are deposited. At necessary intervals these plates are cleaned by washing, rapping or blowing with an air jet, the method of cleaning used depending upon local conditions. The ionizing assembly may be removed from the cabinet for replacement of the bronze ionizing wires. Collector plate cells are constructed from aluminum, brass or special alloys. All parts of the power pack are mounted on a common plate. Total power consumption for one power pack suitable for four collector plate cells is 125 watts.



Collector plate cells, ionizing assembly and power pack are essential parts

Screw Takeup Given Protection

Jeffrey Mfg. Co., Columbus, O., has developed the new protected screw takeup for conveyors and elevators, as shown in the accompanying illustration. The adjusting screw is protected from dust and dirt by an inverted U-shaped shield which extends from end to end of the takeup frame. The sliding base casting, which carries a bronze adjustment nut, is cored out in such a way that it slides freely over the shield.

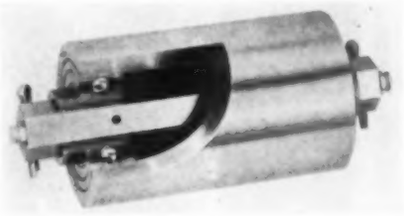


The sliding base casting is cored out to slide freely over shield

This relieves the shield of any function other than protection of the screw. As the adjusting screw does not travel but remains inside the frame, it is protected from damage at all times. After adjustment, the bearing is clamped rigidly to the steel frame.

Design Two New Ball Bearing Rollers

Mathews Conveyer Co., Ellwood City, Pa., has developed two new ball bearing rollers suitable for heavy duty service. Both incorporate self contained double seals which protect the bearings and ball raceways from foreign matter. The accompanying illustration shows one type which is available in 4, 4¼ and 4½ inch diameters. Rollers are in standard lengths from 6 to 48 inches, spaced center to center from 6 inches up, to suit specific requirements.

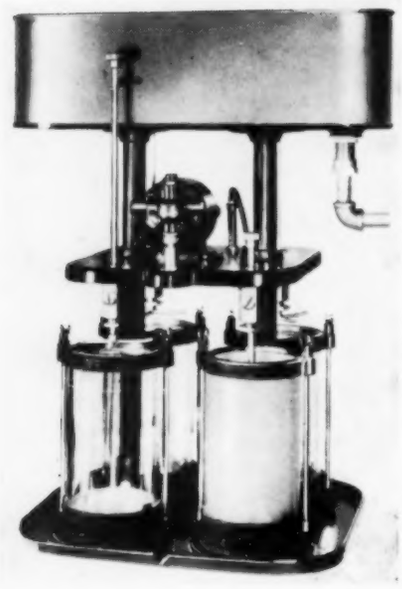


Rollers are in standard lengths from 6 to 48 inches

Industrial grease fittings are used and afford a means of periodical lubrication. Load ratings vary with the three available diameters. The second type design includes similar features to those already described. It is available in 5-inch diameter and is applied for both power driven and gravity applications. Each roller has a continuous load rating of 8000 pounds per roller. Both types incorporate hexagon axles thus preventing the inner ball raceway from rotating on the axle which is held stationary in the conveyor frame. Seamless steel tubing is used in both designs.

Clay Washer Handles Four Samples

Harry W. Dietert Co., Detroit, has developed a clay washer, shown in the accompanying illustration, which automatically washes the clay substance from molding sands. Four samples may be washed at one time. Wash bottles with removable bottoms are supplied so that the clay free sand grains may be removed



Clay free sand grains may be removed from bottles and dried without filtering

from the bottles and dried in the oven without filtering.

The clay washer consists essentially of the following: A base receiving the four bottles; two supporting posts with a table, on which is mounted the motor and drive mechanism to rotate the four washing tubes immersed in the sand sample; and a water tank containing a float valve to maintain a constant level of water in the tank. Water from the tank travels through the posts to the rotated stirring tubes. The water leaves these tubes in a four pronged crow foot located at the bottom of the tubes. This causes the clay to be washed out of the molding sand. Water will carry out of the bottle only particles 20 microns and smaller. The washer has a net weight of 70 pounds, a height of 24 inches and uses alternating or direct current, single phase, 110 or 220 volt motors.

Pattern Alloy Is Nonshrinking

For the duplication of wood master patterns to be used in constructing aluminum matchplates, a bismuth-lead alloy has been found to produce good results. The alloy containing 55 per cent bismuth and 45 per cent lead was developed by the Cerro de Pasco Copper Corp., New York. According to the manufacturer, the alloy expands slightly on cooling, just sufficient to compensate for the loss in size due to cleaning up the castings.

The bismuth-lead alloy melts at 225 degrees Fahr. so that it can be melted in an ordinary ladle or similar container over a small gas flame. It is said to be quite fluid in the molten state and to cast well in sand, plaster, wood or paper molds. A pouring temperature of 310 degrees Fahr. is recommended for long, thin castings, and one of 270 degrees Fahr. for thick, solid castings. The alloy is somewhat lighter than the 13 per cent antimony-87 per cent lead alloy often used for patterns. It is not so brittle or hard, is much more ductile, and has a slightly lower tensile strength than antimonial lead.

The alloy solders readily to brass, and a satisfactory solder for the purpose consists of two parts of the alloy combined with one part of tin. The two are melted together and then poured into a wooden mold or onto a flat iron plate. A solder flux made of muriatic acid *killed* with metallic zinc generally is employed. It is claimed that due to its nonshrinking properties and its fluidity, the bismuth-lead alloy reproduces accurately the fine detail of ornamental master patterns, and reduces to the minimum, the expense of hand chasing.

Anneals Castings In Short Cycle

Electric Furnace Co., Salem, O., has constructed a new type special atmosphere furnace for scale free, short cycle annealing malleable castings. This furnace, shown in the accompanying illustration, is the continuous roller type and handles approximately 30 tons of castings per day, operating on a cycle requiring about 13 hours in the furnace. Castings to be annealed, consisting of miscellaneous small and large shapes, are loaded into alloy trays or baskets which travel through the furnace in two parallel rows directly on specially designed rollers which serve as the furnace hearth.

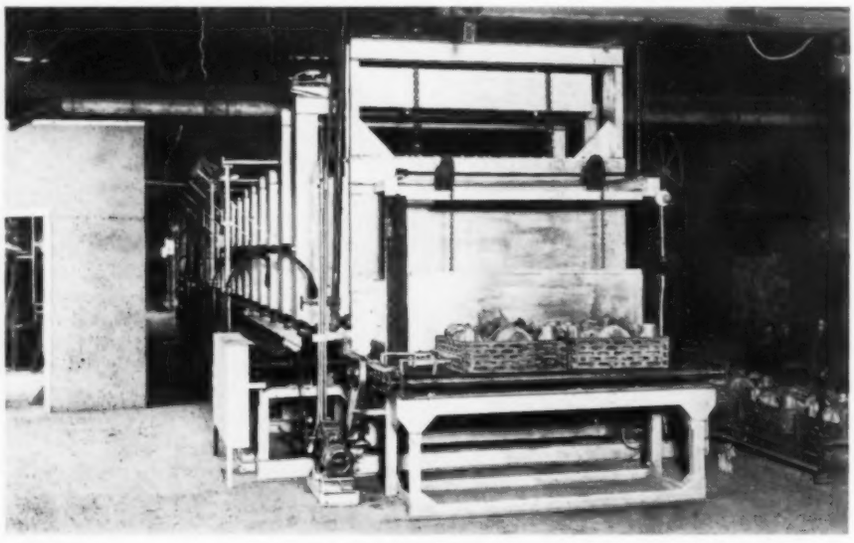
The trays are loaded on an extension at the charging end of the furnace. At a suitable time interval, the charging door of the charging vestibule opens. An auxiliary high speed drive mechanism rapidly charges the loaded trays into the vestibule. This door closes and the door of the heating chamber opens automatically to receive the loaded trays which are conveyed slowly and continuously through the heating and cooling chambers. On reaching the discharge position, the trays actuate a limit switch which automatically opens the discharge door. Trays are delivered rapidly to a gas lock chamber or vestibule.

The door closes and material is moved out onto a 2-tray transfer car and dumping equipment. Empty trays then are placed on a gravity conveyor extending along the side of the furnace and carried to the charging end where they are loaded for another cycle. The furnace is built gas-tight and a special non-oxidizing atmosphere, obtained from an adjacent gas generator, is used in the heating and cooling chambers so that the uniformly annealed castings emerge free of scale.

Heating elements used are heavy cast nickel-chromium alloy grids located in the roof and bottom of the heating and soaking chambers. Heating elements are divided into seven separately and automatically controlled zones. While the new unit is 120 feet long, such units may be designed for larger or smaller capacities and varying cycles depending on requirements.

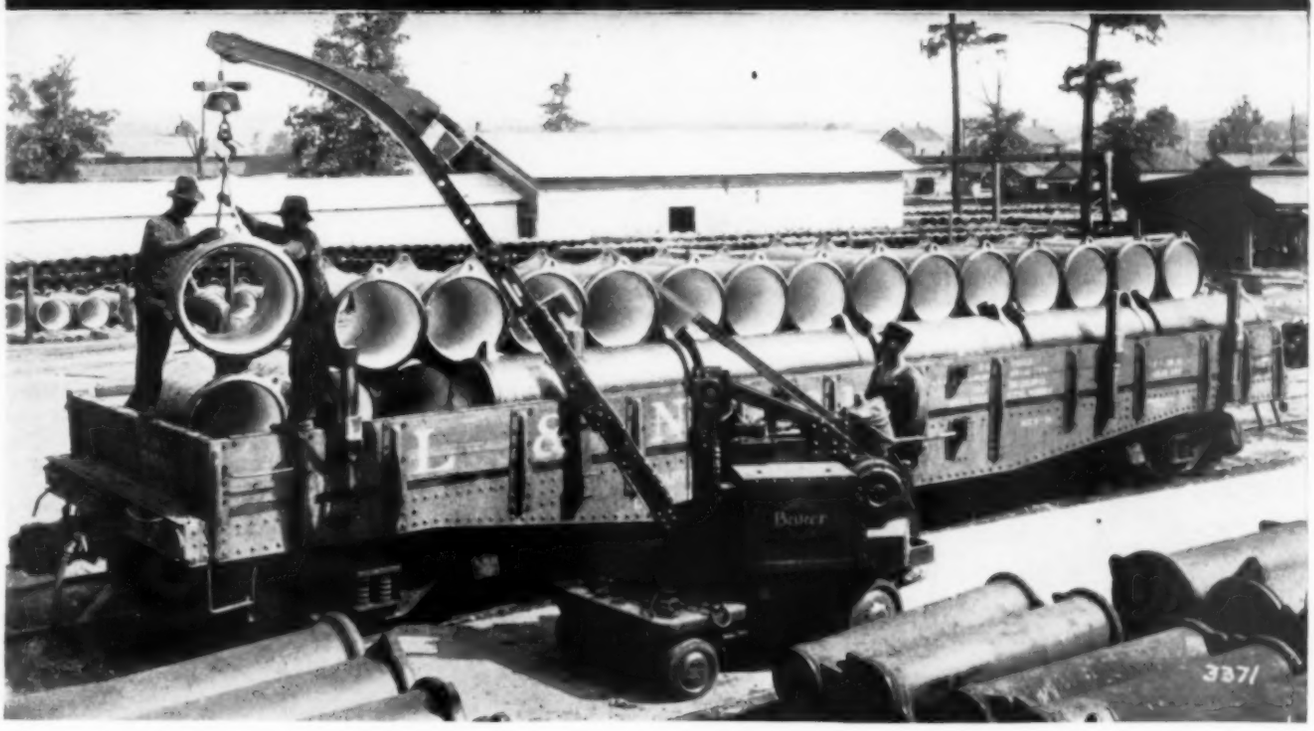
Moves Office

Lincoln Electric Co., Cleveland, has moved its Cincinnati office from Fifth and Baymiller street to room 602, American building, Central parkway at Walnut street.

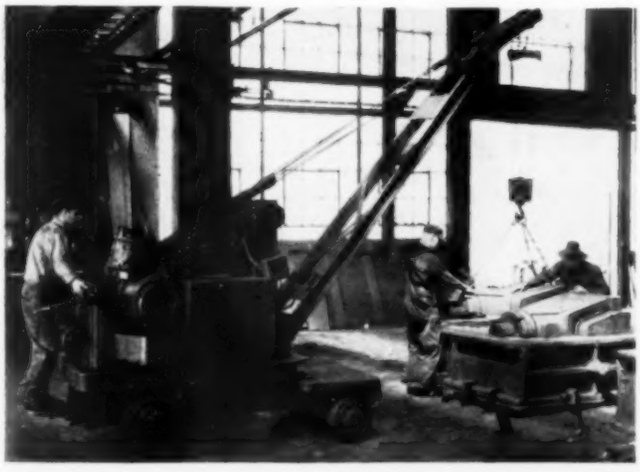


Castings to be annealed are loaded into alloy trays which travel through the furnace on specially designed rollers

Delicate Cores or HEAVY CASTINGS



● BAKER Crane Trucks are only one of many types developed for foundry and heavy industrial work. Because of the completeness of the Baker line and the broad experience of its engineers, you can get sound, unprejudiced counsel from Baker material-handling engineers. For descriptive bulletins, catalog or special information write or phone the address below.



RUGGEDLY built to stand the gaff of jobs which require constant heavy-duty service . . . yet so accurately controllable that delicate cores can be set in place without breakage . . . BAKER Crane Trucks are the "Handy Andies" of foundry operation, popular with men and management wherever used. Indoors and out Baker Cranes travel speedily from job to job, always in demand and always saving time and money on both routine and emergency work.

Capacities, 3,000 to 10,000 lbs. at 5 to 8 ft. Telescoping or rigid booms furnished up to 20 ft. in length. Hoisting, slewing and topping motions independently controlled from operator's position.

Baker

BAKER INDUSTRIAL TRUCK DIVISION
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The most economical way to handle material is NOT to HANDle it

Measures Furnace Atmosphere

Brown Instrument Co., Philadelphia, has developed an instrument for measuring furnace atmosphere quality. The recording instrument is of the potentiometer type and is equipped with a 12-inch wide chart graduated to render the equipment applicable to measure atmosphere whether it results from complete or incomplete combustion or from dissociation. The chart is divided into two sections.

The equipment operates on the principle of measuring the thermal conductivity of the gas mixture which is drawn continuously from the furnace. If the gas is the result of complete combustion, thermal conductivity will be less than 1.00 due to carbon dioxide. If the sample has been produced by incomplete combustion or dissociation, thermal conductivity will be greater than 1.00, except when there is less than one per cent combustible in the final mixture.

Dust Arrestor May Be Portable

Parsons Engineering Corp., 6511 Cedar avenue, Cleveland, has developed the unit type dust arrestor shown in the accompanying illustration. The unit is intended for such applications as grinding wheels, tumbling mills, small pulverizers, screening equipment and similar operations where a restricted amount of air is handled.

The arrestor unit may be either stationary or portable

The arrestor may be made portable by a small truck. With fan and drive mounted directly on the top, it may be set in any convenient space near equipment being ventilated. It is shipped completely assembled, ready for operation. Horsepower ranges from 1½ to 5.

Develops Automatic Overload Device

General Electric Co., Schenectady, N. Y., has developed a new thermal overload switch for fractional horsepower motors. The unit operates on line current and is arranged for convenient mounting on the conduit of terminal box of the motor. The device automatically disconnects the motor from the line when an overload occurs, before the motor reaches a dangerous temperature. When the motor has cooled it is automatically reconnected to the line, the entire operation being repeated at a safe interval until the motor is free of overload or removed from the line.

Elements of the switch consist of a thermostatic bimetallic helix, a heater helix, a flat steel spring and a contact arm. The bimetallic helix is fixed at one end. When heated to a temperature above normal, the free end rotates and reverses the bow of the steel spring. When the spring passes dead center, it also moves the contact arm and disconnects the motor from the line. With the line open, current ceases to flow in the heater helix and the bimetallic helix turns in the opposite direction. When the temperature is normal, the spring snaps to the "on" position.

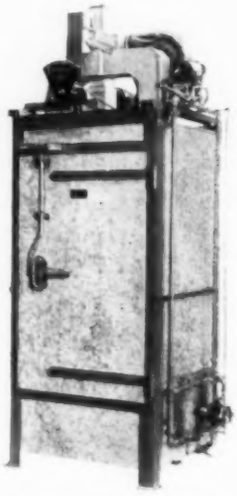
Reflectors Used on Vapor Lamps

A new angle type vapor proof reflector for use with 250-watt high intensity mercury vapor lamps has been designed by the Westinghouse Electric & Mfg. Co., East Pittsburgh. In locations with overhead obstructions, these units, mounted on the sidewalls, are said to provide good illumination on horizontal or vertical surfaces. The unit consists of a cast iron hood with medium socket, an opal glass globe and a porcelain enamel reflector. The hood, finished in green baked acid resisting enamel, is tapped for a ½-inch conduit.

The hood also will attach to a standard 4-inch sheet metal outlet box and is claimed to be vapor proof, regardless of whether or not it is attached to a vapor proof conduit box. A medium base front connected socket is mounted rigidly in the hood and properly positions the lamp in the globe and reflector. Hood and globe are threaded and gaskets are provided for the vapor proof enclosing globe.

Laboratory Oven Has Five Sizes

Paul Maehler Co., 2216 West Lake street, Chicago, has constructed a laboratory type oven, shown in the accompanying illustration, in five standard sizes. Gas or electric heated, it has forced air circulation, for baking or drying operations to 500 degrees Fahr. The oven is built for test baking or drying of paints, varnishes, chemicals, wood or fibre products, cores, molds, or other materials in small batches.

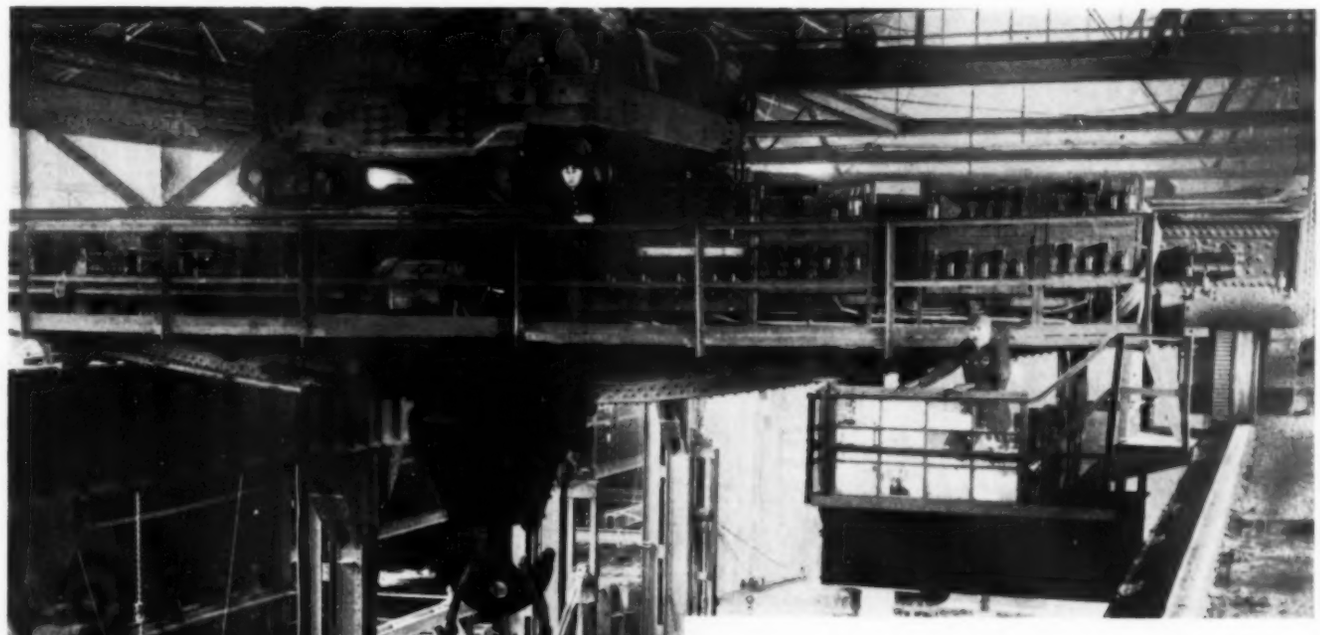


Heated air is distributed by a fan for even distribution

Heated air is distributed by a fan which is said to result in distribution through the oven within a range of 5 degrees Fahr. Thermostatic control maintains temperature at any predetermined setting. Insulation reduces radiation losses. Gas burners are of the atmospheric type and can be used for manufactured, natural, butane or mixtures of these gases. When desirable, electric heating also can be used with forced circulation. The oven is shipped complete and, when connected to gas line and exhaust duct, is ready for operation.

Lloyd B. Edwards Co., Minneapolis, recently has been appointed as agent for the Harnischfeger Corp. to sell overhead cranes, hoists and motors in Minnesota, North and South Dakota. The company is located at 840 Lumber Exchange building, Minneapolis.

It's ALL in the Day's Work



EVEN with a 200 ton crane booming overhead, workmen in the shop below have implicit confidence in their safety. Make sure that they're as safe as they feel. Make sure that USS Wrought Steel Crane Wheels are carrying your heaviest loads.

Why? Because USS Wrought Steel Wheels have proved their absolute reliability under strenuous service. A special rim toughening process so toughens treads and flanges that wear is exceptionally slow and even. Wheel life is thus further prolonged. Maintenance of proper alignment of Crane Bridge is made simple and inexpensive. Number of wheel changes is reduced. Tear-down repairs—which you start on week-ends but which often run into production hours on Monday and Tuesday — are seldom necessary.

Specify USS Wrought Steel Wheels with assurance that you will get lasting, efficient and above all, safe and dependable operation. Double flange or single flange, they are furnished rough machined, or finish machined with finish bore and keyway . . . rim toughened or untreated as desired.

U·S·S WROUGHT STEEL CRANE WHEELS

CARNEGIE-ILLINOIS STEEL CORPORATION

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Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Obituary

FRED B. ERB, president and general manager, Eaton-Erb Foundry Co. of Detroit and Vassar, Mich., a past president of the American Foundrymen's association and for many years a leader in the foundry industry, died unexpectedly on board the S. S. NEW YORK, Feb. 20, shortly after sailing on a Caribbean cruise. The funeral service was held in Royal Oak, Mich., Saturday, March 6.

Mr. Erb was born April 30, 1886 in Royal Oak, Mich. He was educated in the public schools of Royal Oak, and Birmingham, Mich., and was graduated from the University of Michigan in 1908. Mr. Erb began his foundry career immediately after graduation when he became connected with the Detroit Stoker & Foundry Co. as an engineer. He quickly progressed through the various departments and became foundry superintendent, a position he held until 1913.

Fred B. Erb

He then joined the Lakeside Foundry Co. as superintendent, and remained there until 1915 when he resigned to become associated with the Elmira Foundry Co., Elmira, N. Y. A year later, he returned to Detroit to become foundry manager of the Packard Motor Car Co.

In 1925 he left the Packard company and with B. A. Joyce organized the Erb-Joyce Foundry Co. with a plant at Vassar. In 1932 Mr. Erb collaborated with J. O. Eaton of the Eaton Mfg. Co., and purchased the Holley Permanent Mold Machine Co. Inc., Detroit, merging the two foundries to form the Eaton-Erb Foundry Co.

For many years Mr. Erb had been active in the work of various foundry associations, serving on the board of directors and as vice president and president of the American Foundrymen's association, and as president of the Detroit Foundrymen's association. He also was a member of the delegation which attended the International Foundry congress in England in 1929. Mr. Erb was a member of the National Founders' association, and served as an officer or director in the following: Newark Mfg. Co., Slayter & Co., L. A. Walden & Co., and the First Management foundation.

♦ ♦ ♦

Albert H. Schneider, 63, veteran superintendent for the Crouse-Hinds Co., Syracuse, N. Y., died recently in Syracuse. Mr. Schneider had been superintendent of the company's plant for 40 years.

♦ ♦ ♦

David Balkansky, 57, leader in the metalworking industries at Manitowoc, Wis., died Feb. 19 after an illness of 5 months. Mr. Balkansky was born in Russia and settled in Manitowoc in 1896. He was one of the founders of the Manitowoc Brass Foundry, Wisconsin Aluminum Foundry Co., and Manitowoc Iron & Metal Co.

♦ ♦ ♦

Tennis Wick, 57, retired member of the A. H. Wick Realty Co., Cleveland, and former vice president of the Fox Furnace Co., Elyria, O., died Feb. 23 in Cleveland. Mr. Wick was born in Cleveland and went to Elyria about 30 years ago as vice president of the Fox Furnace Co. He held that position until 10 years ago when the company was acquired by the American Radiator Co.

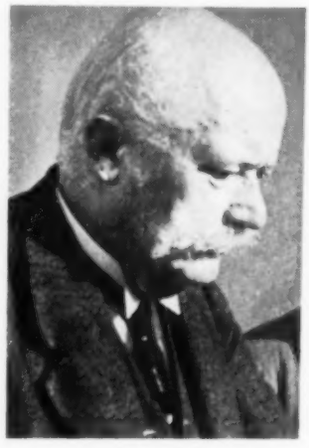
♦ ♦ ♦

George Hammink, 62, former director for several years of the Wellman Bronze & Aluminum Co., Cleveland, died at Cleveland Heights, O., Feb. 8. He was born in Holland and taken to Cleveland by his parents when he was 9 years old. When Mr. Hammink was only 25, he organized the City Brass Foundry, Cleveland, of which he was president until selling the company in 1926. He served as manufacturing agent there until 1932 when he became president of the Roberts Steam Specialty Co. At the time of his death, he retained that position and was affiliated with the Wellman company.

♦ ♦ ♦

Dr. Paul Aulich, chairman of the technical committee on molding and allied materials of the Verein deutscher Giessereifachleute, died in Duisburg, Germany, on Jan. 13 . He was recognized as a foundry authority not only in Germany, but also in Europe and the United States, particularly for his investigations on molding sands. He attended the Detroit convention of the A.F.A. in 1936 as the representative of the German foundrymen, and urged attendance at the International Foundry congress to be held later in Dusseldorf. Dr. Aulich was born in Polkwitz on Oct. 19, 1867 and received his early education at the Glogau gymnasium. He then studied at the universities of Berlin, Munich and Geneva. At the latter he was assistant to Professor Graefe, and later served as assistant to Alexander Classen at Aachen.

Then for 6 years Dr. Aulich was assistant superintendent and superintendent of blast furnaces for Marchienne-au-Pont, Belgium. In 1899 he became an instructor in the State Metallurgical school at Duisburg where he served until his retirement from active instruction in 1931. He was noted as a linguist and spoke fluently in English and the Romance languages in addition to his own German. Dr. Aulich wrote numerous articles for the foundry field and was author of the section on foundry raw materials in the *Handbook* of the Vereins Deutscher Eisengiesereien. The last ten years of his life were spent in a study of molding sands, and he was responsible for the German standard proposal for testing molding sands, recently published.



Dr. Paul Aulich

♦ ♦ ♦

William H. Hill, 69, vice president and a director of the American Radiator Co. and chairman of the board of the company's affiliate, Fox Furnace Co., died in New York Jan. 29. He was one of the founders of the American Radiator Co. in 1892. Prior to that time he had been connected with the Michigan Radiator & Iron Co., Detroit. Mr. Hill went to the executive offices of the company in Chicago in 1902, after managing the New York office for seven years. He remained in Chicago until

(*Concluded on page* 102)

are poured daily with—
Modern Improved Bottom-Pour Ladles

Clean, hot metal is tapped off the bottom of the ladle; the Modern *exclusive* precision control enables pouring very light section castings with substantial increase in yield; bottom-pour mechanism operates in totally enclosed oil tight housing.

Send for our new ladle catalog.

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MODERN EQUIPMENT COMPANY

PORT WASHINGTON, WIS., DEPT. 129

"Plan now to see the MODERN EXHIBIT at the Milwaukee Convention"

MODERN EQUIPMENT CO.

(*Concluded from page* 100)

1904 when he was made vice president and general manager of manufacturing. From 1915 to 1921 Mr. Hill was vice president and treasurer of the company. In the latter year he was made president of the Fox Furnace Co., from which position he retired in 1930.

♦ ♦ ♦

E. H. Weatherhead, 80, former vice president and director of the Bishop & Babcock Mfg. Co., Cleveland, died Jan. 21 in Riverside, Calif., where he had been living since his retirement 10 years ago. Mr. Weatherhead was born in Cleveland and spent his entire business life there. With his brother, the late A. J. Weatherhead, he founded the Cleveland Faucet Co. and acted as vice president and director. When that company was merged with the Bishop & Babcock Mfg. Co., he assumed the same office with the latter company.

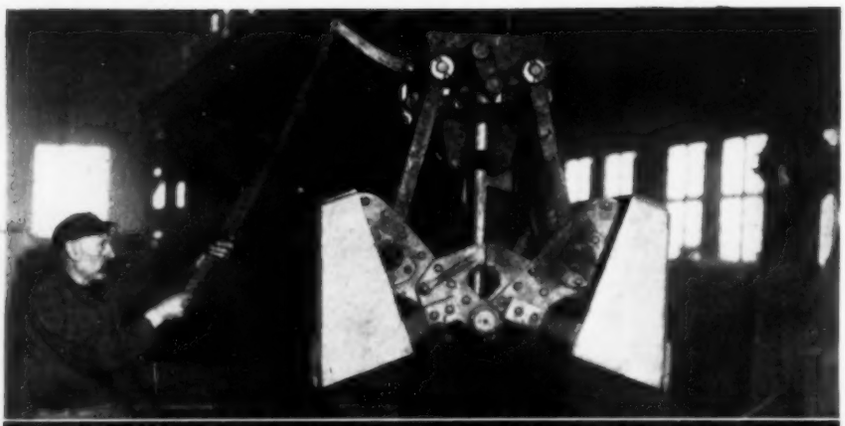
♦ ♦ ♦

Arthur James Bazeley, 65, mechanical and designing engineer, National Malleable & Steel Castings Co., Cleveland, died in Cleveland Jan. 30. Mr. Bazeley was born in Bristol, England, and came to America when he was 19. He had been employed by the National Malleable company for 44 years and during that time had contributed many improvements and developments to railroad equipment. He was chief designer of the standard railroad car couplers now in use.

♦ ♦ ♦

Luman S. Brown, 81, president of the Springfield Facing Co., Springfield, Mass., died at his winter home in Daytona Beach, Fla., Jan. 16. Mr. Brown was a native of Springfield and attended public school in that city. He worked at several odd jobs for a time and in 1882 founded the Springfield Facing Co. at Willimansett, for the manufacture of foundry supplies, and retained the position of president for 57 years. Mr. Brown was well-known in Springfield and vicinity, due to his having pioneered in the selling of charcoal to the general public by the use of unique and original advertising. Recently he had been made an honorary member of the Springfield Rotary club—an organization in which he took an active interest for many years.

PICK UP EXTRA PROFITS *in your foundry*



P&H GRAB BUCKETS

● Put an end to back-breaking methods in your foundry. Increase your crane's service capacity. Hook on a P&H single-line grab bucket and eliminate waste hours spent in cleaning and mixing operations. . . . There's no need to increase your floor space . . . no need to raise your crane runway . . . P&H grab buckets are adapted to low headroom conditions. They're easy to attach or set aside, as work requires. There's nothing to get out of order—no upkeep expense. They work as quickly as your crane will hoist them—they save enough man-hours to pay for themselves in a short time. Write the Harnischfeger Corporation, 4405 West National Avenue, Milwaukee, Wis.

ASK FOR BULLETIN SL-2

HARNISCHFEGER CORPORATION

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Gray Iron Society Plans Meeting

Annual meeting of the Gray Iron Founders' society will be held at the Hotel Cleveland, Cleveland, Friday and Saturday, June 11 and 12. Further details of the program will be announced later.

Builds Addition

Pangborn Corp., Hagerstown, Md., is making extensive additions to its plant. This building expansion program involves an expenditure of approximately $80,000, for building and new equipment. The plant is operating on a two shift basis.

Publishes Papers

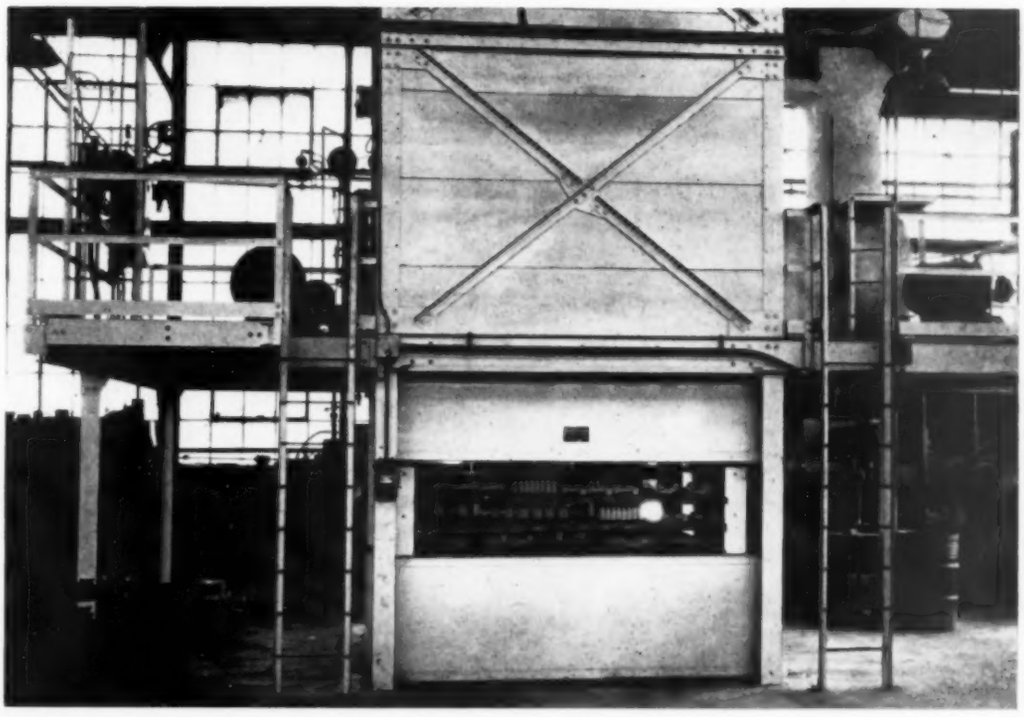
Bureau of mines, Washington, recently has published two technical papers on coking properties of coals. One is technical paper No. 570 on "Carbonizing Properties and Petrographic Composition of Clintwood Bed Coal from Buchanan Mines Nos. 1 and 2, Buchanan county, Va." The other is technical paper No. 571 entitled "Carbonizing Properties and Petrographic Composition of Pittsburgh Bed Coal from Pittsburgh Terminal No. 95 Washington county, Pa." Copies of the papers may be obtained from the superintendent of documents, Washington, for 10 cents each.

MODERN AND UNUSUAL DEVELOPMENT IN

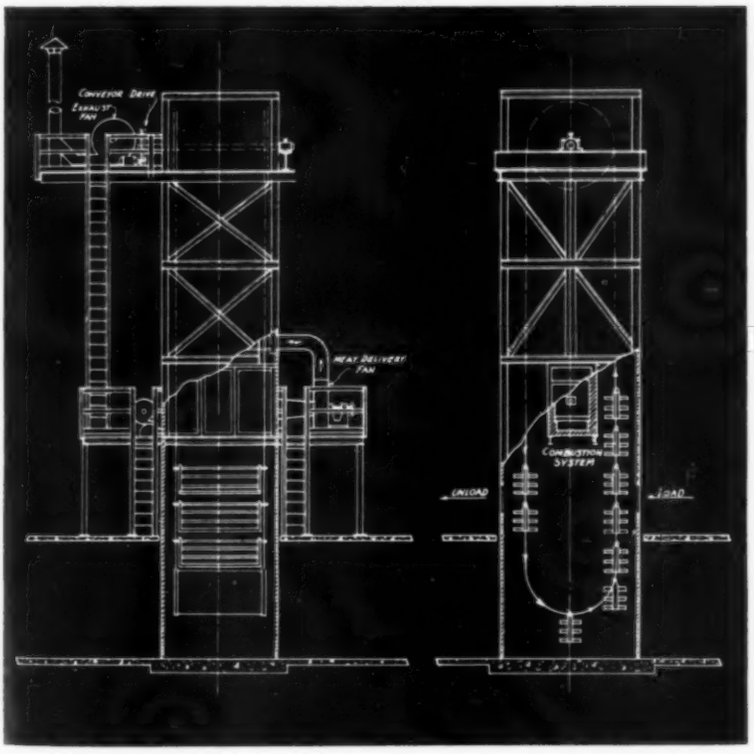
Vertical Core Ovens

(PATENTS APPLIED FOR)

By
Carl-Mayer



VERTICAL CORE OVEN
Air Heater—Oil Fired,
Harrison Radiator Corp.
(Subsidiary) General Motors



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Carl-Mayer in the development and successful application of this large, modern, "AIR HEATER" fired, VERTICAL CORE OVEN has again demonstrated the ability of this organization to develop and to improve on outmoded methods, principles and economies. Carl-Mayer core oven equipment chosen for large recent installations by such prominent concerns as:

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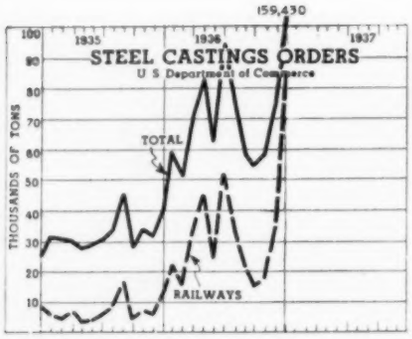
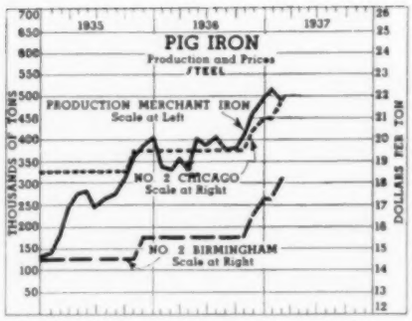
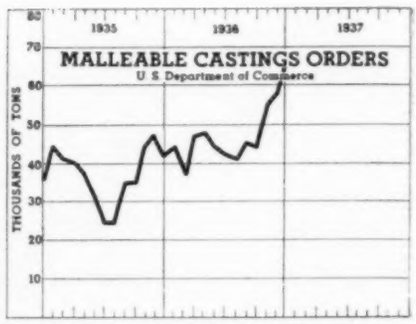






Foundry Activities

WILSON FOUNDRY & MACHINE CO., Pontiac, Mich., formerly a subsidiary of the Willys-Overland Co., Toledo, O., has been made an independent company with Charles E. Wilson, president; A. L. Weber, vice president; George P. Waller, secretary-treasurer, and R. S. Whipple, assistant secretary-treasurer. D. R. Wilson, former president of the Pontiac company has resigned to devote his entire time to the affairs of Willys-Overland Inc., of which he is president. The Wilson foundry will do a jobbing business and will continue to make and machine all castings for the Willys-Overland engines.

* * *

Lynchburg Foundry Co., Lynchburg, Va., was damaged recently to the extent of $20,000.

* * *

Southern Co-operative Foundry Co., Rome, Ga., plans to build a 1-story, 65 x 140-foot foundry.

* * *

Electro Alloys Co., Elyria, O., has opened a new Cleveland sales office at 5005 Euclid avenue. H. I. Dixon is in charge.

* * *

Liberty Foundry Co., St. Louis, has started plans for an additional foundry building to cost $25,000. William T. Mellow is vice president.

* * *

Acme Die Casting Co., Detroit, has been incorporated. Daniel D. J. Jend, 1127 Berkshire road, Grosse Pointe, Mich., is correspondent.

* * *

General Malleable Corp., Waukesha, Wis., suffered damage to its plant recently due to flood waters reaching boilers and annealing ovens. L. K. Harkreider is president and general manager.

* * *

Forging & Casting Corp., Ferndale, Mich., expects to place in operation, late in March, its new plant for the production of gray iron castings.

* * *

J. I. Case Co., Racine, Wis., maker of general farm equipment, has purchased the plant of the Rock Island Plow Co., Rock Island, Ill., and will use it for manufacturing.

* * *

Aller Foundry & Pattern Co., 136 Sotello street, Los Angeles, will construct a brass foundry building at 1453 Beale street. M. V. Storm is manager.

* * *

Garrard Foundry Co., 320 East Eighth street, Holland, Mich., has been incorporated to manufacture castings. James G. Garrard is correspondent.

* * *

American Car & Foundry Co., Madison, Ill., will open its wheel foundry shortly. The company expects to have the entire plant in operation during the year.

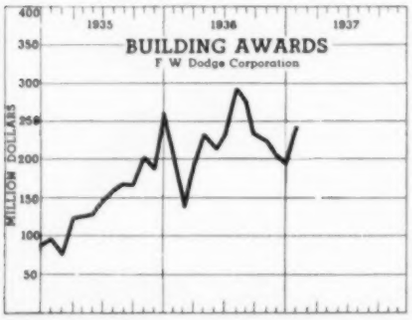
* * *

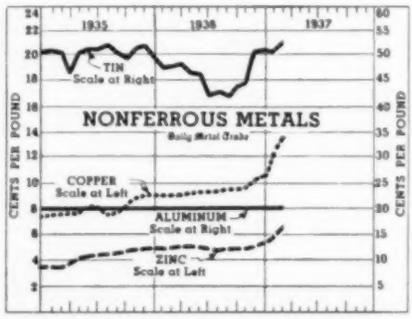
Index of foundry equipment orders, according to a report of the Foundry Equipment Manufacturer's association, Cleveland, was 190.9 in January, 1937, as compared with

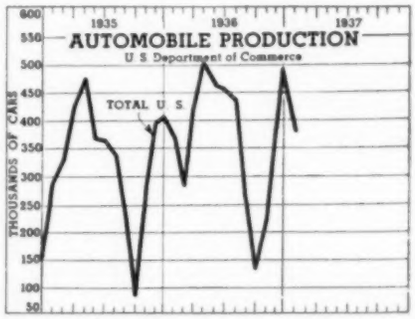
(*Concluded on page* 106)

RAW MATERIAL PRICES
March 8, 1937

Iron	
No. 2 foundry, Valley	$24.00
No. 2 Southern Birmingham	20.00
No. 2 foundry, Chicago	24.00
No. 2 foundry, Buffalo	24.00
Basic, Buffalo	23.00
Basic, Valley	23.50
Malleable, Chicago	24.00
Malleable, Buffalo	24.50
Charcoal iron, furnace	26.50
Coke	
Connellsville beehive premium	$5.50
Wise county beehive coke	$ 4.50 to 5.00
Detroit by-product delivered	10.85
Scrap	
Heavy melting steel, Valley	$19.00 to $19.50
Heavy melting steel, Pitts. (dlv.)	21.50 to 22.00
Heavy melting steel, Chicago	20.00 to 20.50
Steve plate, Buffalo	14.00 to 14.50
Stove plate, Chicago	12.00 to 12.50
No. 1 cast, New York	15.00 to 15.25
No. 1 cast, mchy., Chicago	17.00 to 17.50
No. 1 cast, Pittsburgh	19.00 to 19.50
No. 1 cast, Philadelphia	19.00 to 19.50
No. 1 cast, Birmingham	13.00 to 14.00
Car wheels, iron, Pittsburgh	19.50 to 20.00
Car wheels, iron, Chicago	20.00 to 20.50
Railroad malleable, Chicago	22.50 to 23.00
Malleable, Buffalo	19.00 to 20.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	16.00
Straights tin	59.87½
Aluminum, 99 per cent	20.00 to 21.00
Aluminum, No. 12 (Secordary, standard)	17.75 to 18.25
Lead, New York	7.25
Antimony, New York	16.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	7.50

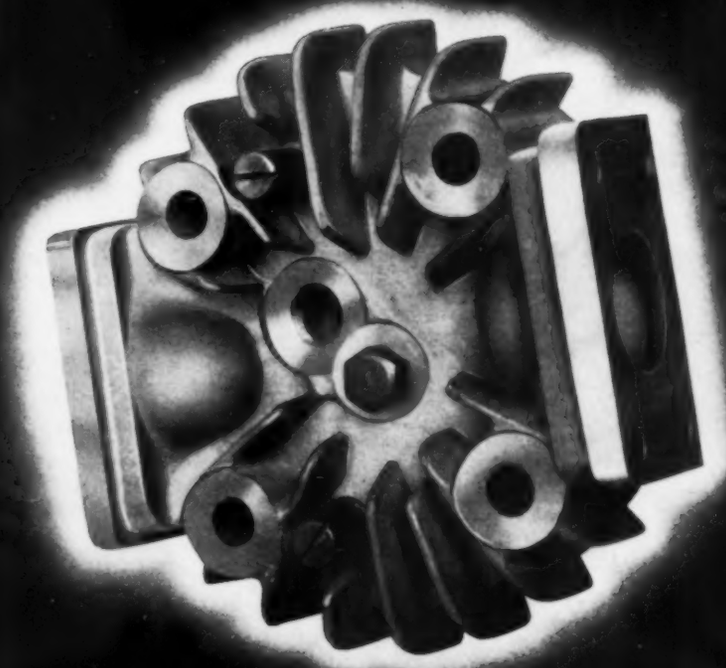






TAMCO

Better performance thru better metals



UNIFORM *Strength*

TAM *Foundry* **FERROTITANIUM**

Titanium acts in three distinct ways to increase the strength of a casting, and make this strength more uniform even in thick sections . . . First, Titanium has a graphitizing effect. This produces a finer, denser grain structure and greater tensile strength . . . Titanium, secondly, as a result of its graphitizing and deoxidizing power, diminishes chilling of the cast iron, and insures slower setting and good life . . . Thirdly, Titanium—due probably to its purifying action in respect to oxygen and nitrogen—eliminates gas layering or films of iron oxide between the crystals and a consequent break in grain continuity . . . Let a TAM Engineer explain how Titanium compounds can be adapted to your casting problems. TAM Metallurgical Alloys, for use with both ferrous and non-ferrous metals, include TAM Foundry Ferro-Titanium, TAM *Original* F. C. T. (Ferro Carbon-Titanium) No. 78, TAM *Low Carbon* Ferro-Titanium (both "40%" and "25%" titanium), TAM Webbite, TAM Cupro-Titanium and many others. May we furnish complete information?

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GENERAL OFFICES AND WORKS . . . NIAGARA FALLS, N. Y., U. S. A.
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(*Concluded from page* 104)

283.3 in December, 1936, and 127.0 in January, 1936. Index of shipments was 177.2 in January, 1937, 187.1 in December, 1936, and 110.4 in January, 1936.

* * *

Howell Foundry Co., Whittier, Calif., has been established at 718 West Penn street. Henry W. Howell, 419 West Newmark street, Monterey Park, Calif., is correspondent.

* * *

National Malleable & Steel Castings Co., Cleveland, has made space reservations for Cleveland's 1937 Great Lakes exposition, which will open May 29 and continue for 101 days.

* * *

B & S Bronze Foundry Inc. recently has moved from 600 East 134th street, New York, to 2 Lombardy street, Brooklyn, N. Y. R. E. Bietry is president.

* * *

Arcade Malleable Iron Co., Worcester, Mass., is installing a new annealing furnace with about four times the capacity of the company's present equipment. The new unit is being constructed by the General Electric Co., Schenectady, N. Y.

* * *

Progressive Brass Mfg. Co., 1702 East Sixth street, Tulsa, Okla., will soon start an expansion program. Foundry space will be increased 75 per cent and new core ovens, an abrasive cut-off machine and a molding machine will be purchased. E. J. Thomas is president.

* * *

General Foundry & Mfg. Co., Flint, Mich., recently became a licensee of the Meehanite Metal Corp., Pittsburgh. It is producing general engineering castings and heat, corrosion, and wear resistant castings by that process.

* * *

George H. Smith Steel Casting Co., Milwaukee, has been purchased by Edward A. Bacon, who has become president and treasurer. Other officers are: Secretary, W. J. Donnelly; controller, P. W. Kaufmann. The company was founded in 1896 by George H. Smith, brother of the founder of the A. O. Smith Corp., Milwaukee, and is regarded as the oldest existing steel foundry in Wisconsin.

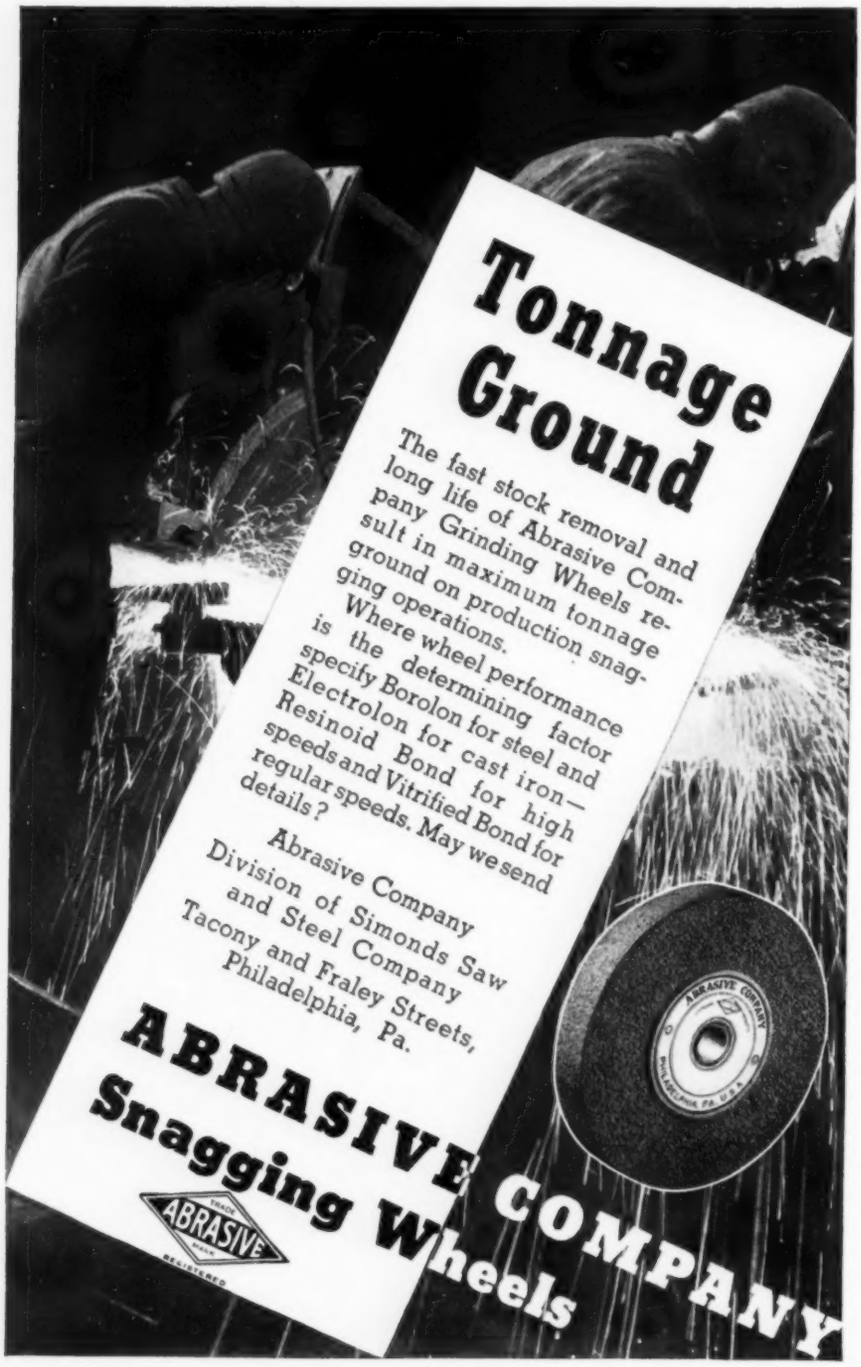
* * *

Kruckemeyer Foundry, Blanchester, O., has joined with Frank Klaine, formerly of the Star Foundry Co., Covington, Ky., in a project to be known as the Kruckemeyer-Klaine Foundry Co. The plant will be located in the building recently vacated by the Reliable Safe Co., Fourteenth street, Covington, Ky. The company will make furnace and stove repair parts and general jobbing castings.

* * *

Output of steel castings produced in the Philadelphia Federal reserve district increased 3.1 per cent during January, according to reports received by the industrial research department of the University of Pennsylvania. This gain in activity raised the total output to a point approximately 90 per cent higher than that reached in January, 1936. In contrast, production of gray iron castings declined more than 7 per cent. Shipments of castings did not reflect the changes in production. Deliveries of steel castings decreased slightly but shipments of iron castings did not fall off as severely as production.

According to the National Safety council, occupational accidents in 1936 added 70,000 permanent disability cases to the death total, and 1,460,000 temporary disability cases, compared to respective totals for 1935 of 63,000 and 1,340,000. Those injuries resulted in a wage loss of $510,000,000 and medical expense billed at $45,000,000. In addition the overhead cost of providing liability and workmen's compensation insurance amounted to about $105,000,000.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The fast stock removal and long life of Abrasive Company Grinding Wheels result in maximum tonnage ground on production snagging operations.
Where wheel performance is the determining factor specify Borolon for steel and Electrolon for cast iron—Resinoid Bond for high speeds and Vitrified Bond for regular speeds. May we send details?
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ABRASIVE COMPANY
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CHAMPION Electric Sand Riddle

CHAMPION Users the World Over Invariably Say—

"It is the most useful piece of equipment we have"

Why?

They have compared the *CHAMPION* with other machines and find it riddles and mixes molding sand, core sand and facing better and faster.

They find the *CHAMPION ELECTRIC SAND RIDDLE* the most economical in power consumption and maintenance and serves all parts of the foundry and core room.

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Riddles Sand

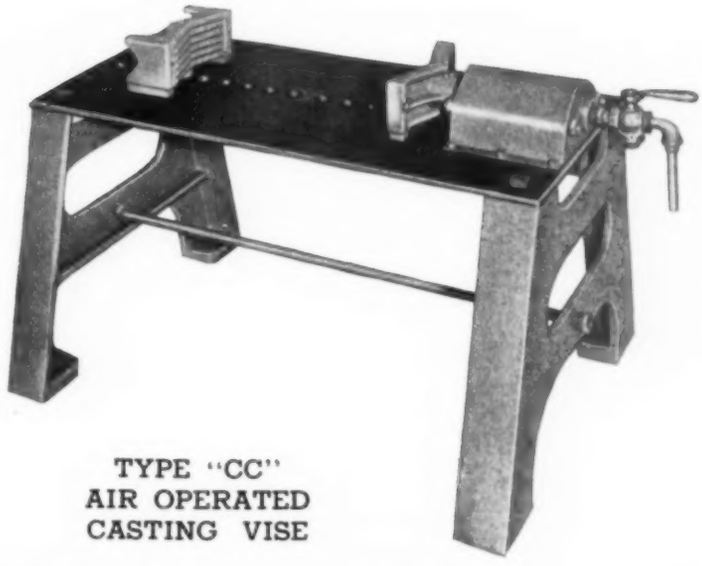
All Over

The World

A low priced tool that should be in every cleaning room.

500 lbs. pressure holds castings absolutely tight and rigid when grinding or chipping and insures MAXIMUM SPEED, SAFETY AND EFFICIENCY.

Machine is of substantial construction with $\frac{3}{8}$" steel plate table and cast steel jaws, designed to hold castings of all shapes. SHIPPED ON TRIAL.



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AIR OPERATED
CASTING VISE

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NEW TRADE PUBLICATIONS

Copies of any of the literature listed below may be obtained by writing directly to the companies involved, or by addressing THE FOUNDRY, in care of Readers' Service Department, 1213 West Third Street, Cleveland

CONVEYING SYSTEMS—Louden Machinery Co., Fairfield, Iowa has issued an attractive bulletin covering its one-piece section for a hand-operated monorail system. Details of this new track for conveying are given, including description of switches, curves, steel framing, etc.

HEATING SYSTEMS—Lee Air Heater Co., 222 West Rayen avenue, Youngstown, O., has prepared a booklet on its line of direct hot air heating systems. Special features of the company's development of that type of heater are given, with typical installations in foundries.

CLEANING—Cleveland Crane & Engineering Co., Wickliffe, O., has presented information, in an attractive bulletin, concerning the company's tramrail and carrier units for cleaning boiler rooms and windows. Operations of the units and description of their construction details are considered.

AUTOMATIC SWITCHGEAR—General Electric Co., Schenectady, N. Y., points out ways in which its automatic switchgear may be used, in a recent publication. Performance of the switchgear on synchronous motor-generator sets, direct current feeders, mercury-arc rectifiers, condensers, etc., is considered in a systematic and clear manner.

FLUID METERS—Bailey Meter Co., 1050 Ivanhoe road, Cleveland, has published a 40-page catalog covering its line of fluid meters for steam, liquids and gases. The manner in which any desired combination of indicating, recording and integrating features may be combined with a flow mechanism is illustrated.

WELDING—Lincoln Electric Co., Cleveland, has published a bulletin on its 200 ampere engine driven arc welder. The generator control, coupling, idling device, etc., is described. How the company's dual continuous control gives any type of arc for each value of welding current also is pointed out. Engine specifications conclude the treatment.

POTENTIOMETERS — Bristol Co., Waterbury, Conn., describes its new recording round-chart potentiometer in a recent bulletin. Drilling dimensions, chart lists and other engineering data pertaining to the unit are included in the following forms: Pyrometer, tachometer, resistance thermometer, millivoltmeter and milliameter.

PACKINGS — United States Rubber Products Inc., New York, has prepared a 112-page booklet on the application of industrial packings for specific purposes. The 12 indexed departments of the manual include sheet packings, gaskets, rod and plunger packings, hydraulic packings, flax and jute, locomotive and special oil well rotary drilling packings, pump valves and miscellaneous.

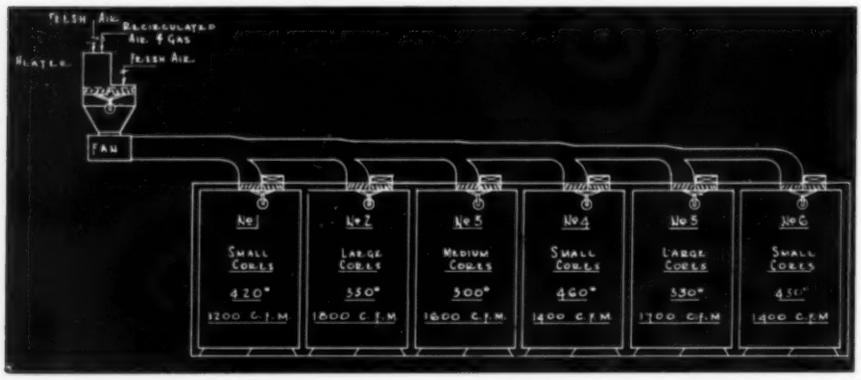
AUTOMATIC CONTROLLERS—Johnston Mfg. Co., Minneapolis, has issued a bulletin covering its valveless automatic controllers for oil burners. Flow of heavy viscous oil to a burner, as regulated by the variable displacement metering pump produced by the company, is discussed in detail. A description of the floating principle, floating controllers and other units is presented.

MAGNETIC ENGINEERING—A standardized catalog containing technical data, illustrations and descriptions of the various phases of magnetic engineering, including numerous types of friction devices employed in power transmission, has been issued by the Stearns Magnetic Mfg. Co., Milwaukee. Also, a bulletin describing a recently-developed drum type magnetic separator for purifying dry pulverized material, applied to the elimination of iron or iron bearing minerals, has been compiled.

THERMAL OVERLOAD SWITCH—General Electric Co., Schenectady, N. Y. Bulletin No. 2369, describing a new thermal overload switch for fractional horsepower motors, operating on line current and arranged for convenient mounting on the conduit or terminal box of the motor; bulletin No. 2525, type ICT-self-reset temperature relay for protecting alternating current machines and transformers against abnormal heating; bulletin No. 2467, giving technical and descriptive data on General Electric light-sensitive cell.

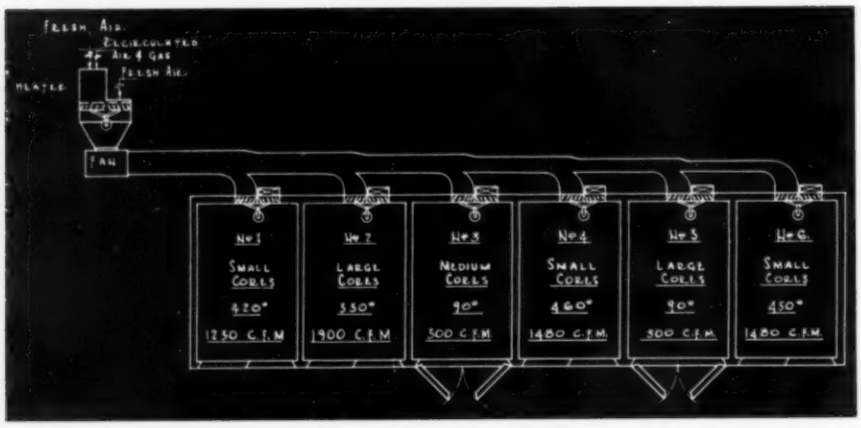
Modernize Your Batch Type Ovens

The D.S.M. Recirculation system permits a single external heater to serve a number of ovens, all of which may require different baking periods and temperatures. For different sizes and shapes of cores.



DIAGRAMATIC LAYOUT—Varying temperatures and volumes in adjoining compartments. One isolated heater—oil or gas fired. Automatic temperature control.

Open an oven or two for unloading. What happens? The temperature in the opened oven is automatically cut off, cold air circulated, and the other ovens continue on under their same baking conditions. No practical change in air volumes or temperatures:



Two compartments opened for unloading. Temperature and volume factors automatically change as indicated above, leaving unchanged temperature and circulation in the compartments still undergoing baking when one or more compartments are being unloaded.

AND IT IS ALL AUTOMATIC. No shifting of hand dampers. The above cuts are diagramatic only, and are not intended to illustrate the interior circulating system in the ovens. Sketch and dimensions of your present installation will enable us to advise cost of modernization.

DETROIT SHEET METAL WORKS

DETROIT - - MICHIGAN

1270 Oakman Boulevard